NATURAL FLOOD MANGEMENT APPLICATIONS (NFM): THE ROLE OF LOCAL INSTITUTIONS

A thesis submitted for the Degree of Doctor of Philosophy (PhD)

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DECLARATION

Candidate's declarations

I Ndenyangnde Ripiye, certify that this thesis submitted in partial fulfilment of the requirement for the award of Doctor of Philosophy (PhD), Abertay University Dundee, is wholly my work unless otherwise referenced or acknowledged. This work has not been submitted for any qualification at any other academic institution.

Signed ……..…….

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Supervisor's declaration:

I certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree in Abertay University and that the candidate is qualified to submit this thesis in the application for that degree.

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CERTIFICATE OF APPROVAL

I certify that this is a true and accurate version of the thesis approved by the examiners and that all relevant ordinance regulations have been fulfilled.

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DEDICATION

- To Dad and Mum— Ezekiel Iraskep Ripiye and Esther Saraya Ripiye. I am honoured to have you both as parents. Thank you for your endless love, prayers, support and encouragement. I love you.

- To my darling husband - Abiodun Joseph Durojaye

You have been a pillar of strength and hope. Thank you for your patience throughout. My greatest cheerleader!!!

- And to the loving memory of –Mrs Jwambe Jessica Andemun Musa

Forever green in my heart. Rest on sis.

ABSTRACT

Natural Flood Management (NFM) is promoted as part of sustainable flood management (SFM) in response to climate change adaptation. Stakeholder engagement is central to this approach, and current trends are progressively moving towards a collaborative learning approach where stakeholder participation is perceived as one of the indicators of sustainable development. Within this methodology, participation embraces a diversity of knowledge and values underpinned by a philosophy of empowerment, equity, trust and learning.

To identify barriers to NFM uptake, there is a need for a new understanding on how stakeholder participation could be enhanced to benefit individual and community resilience within SFM. This is crucial in the light of climate change threats and scientific reliability concerns. In contributing to this new understanding, this research evaluated eight (8) UK NFM case studies towards improving understanding of opportunities in involving communities in catchment-based working. An NFM strategy for participatory planning was developed from literature, findings from the UK studies and refined through a scenario development for a case study application in Taraba state, Nigeria using the constructivist model.

Stakeholder and inter-agency collaboration for flood management in Taraba were investigated through interview methodology: 8 governmental agencies and 32 community leaders in Potentially Vulnerable Areas (PVA's) of the state. Findings show some institutional weaknesses, which are seen to inhibit the development of adequate, flood management solution locally with damaging implications for vulnerable communities. The existences of weak institutional structures with poor coordination of the lead agency to effect change are identified as problematic within this context. Findings highlight a dominate top-bottom approach to management with very minimal public interactions. Current approaches are remedial with less emphasis on prevention and mitigation. The targeted approach suggested by the constructivist risk model is set against adaptive flood management and community development.

The finding of the study suggests different agencies have different perspectives for "community participation". It also shows communities in the case study area appear to be least influential, denied a real chance of discussing their situations and influencing the decision. This is against the background that the communities are located in the most productive regions, contributing massively to national food supplies. Stakeholder engagement and resilience planning underpin this research.

The study explores dimensions of participation using the self-reliance and self – help approach to develop a methodology that facilitates reflections of currently institutionalised practices and the need to reshape spaces of interactions to enable empowered and meaningful participation. The results are discussed concerning practical implications for addressing interagency partnerships and conducting grassroots collaborations that empower local communities and seek solutions to development challenges.

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ACRONYMS AND ABBREVIATIONS

CBEP	Community Based Environmental Planning
CBO	Community Based Organisations
CSO	Civil Society Organisations
CPP	Community Partnership Platforms
EV	Environmental Values
FBO	Faith Based Organisations
FRM	Flood Risk Management
GEF	Global Environment Facility's
IDPs	Internally Displaced People
LEMA	Local Emergency Management Agency
LGA	Local Government Areas
MEUD	Ministry for the Environment and Urban Development
NAPA	National Adaptation Programs of Action
NASPA- CCN	National Adaptation Strategy and Plan of Action on Climate Change for Nigeria
NEMA	National Emergency Management Agency
NFM	Natural Flooding Management
NWC	National Water Commission
PVAs	Potential Vulnerable Areas
SCCF	Special Climate Change Fund
SD	Sustainable Development
SEMA	State Emergency Management Agency
SPA	Strategic Priority for Adaptation
SRDP	Scottish Rural Development Programme
UBDA	Upper Benue Development Authority
UBVN	Upper Benue Valley, Nigeria
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	UN Office for Disaster Risk Reduction

CHAPTER 1

1. FLOOD RISKS AS SOCIAL BASED AND SITUATED PHENOMENA

"……Partnerships should focus on results today and make progress for the long term. We have no time to waste and much to gain by acting now. With climate impacts accelerating around the world, we need to prioritise adaptation alongside mitigation in the action agenda. Here, too, there are many opportunities. Climate resilient innovations are needed to help billions of people adapt to increasing droughts, floods, temperatures and other impacts. Adaptation is not a luxury. It is a prudent investment in our future……. UN Secretary- General Ban Ki-moon". (UN, 2016)

1.1 Background of Study

The management of flood risk continues to be a challenge due to climate change (CC) impacts and scientific uncertainty (Woodward *et al*. 2014; Aerts *et al.* 2008). Climate projections suggest the likely hood of frequent extreme weather (Zhang and Zwiers, 2016; Mathews *et al.* 2015; Trenberth *et al.* 2015). In line with this, climate change adaptation is now a core element of policy and research (Smith *et al*. 2011; Harris, 2011; IPCC, 2014; SBSTA, 2005; EU, 2006; EU, 2007). However, understanding adaptation is conceptually complicated as it concerns adjustment in human systems at different scales and by different actors. Success would be likely perceived differently among scholars, policy makers and communities (Brooks *et al*. 2011; Adger *et al.* 2005). Emerging debates on the roles of pre-emptive learning and cultural understanding of climate change are now essential elements for adaptation. Focus draws on how adaptation could incorporate into a theory of learning for environmental change (Tschakert and Dietrich, 2010).

IPCC (2007) defines adaptation as adjustments in ecological, social or economic systems in response to actual or expected climate stimuli and their effects.

Adaptation is projected to be a process which includes learning about risks, evaluating response options, creating conditions that enable adaptation, mobilising resources and revising choices with new learning (Leary, 2012). IPCC (2014:5) defines resilience as "the capacity of social, economic and environmental systems to cope with a hazardous event of trend or disturbance, respond or reorganised in ways that maintain their essential function, identity, structure, while also keeping the capacity for adaptation, learning and transformation". However, the challenges are substantial, particularly in developing countries where dependencies on climate –sensitive natural resource for livelihoods and incomes are high (IPCC, 2001 and 2007). Furthermore, the capacity for these countries to adapt to changes in climate is scarce due to low levels of human and economic development and high rates of poverty. These factors combine to create a state of high vulnerability to climate change in much of the developing world.

Birkmann *et al*., (2011), places most definitions to be inclined to contexts of (human) ecology and research on inherent risks. He further notes conceptions rarely connect to theoretical approaches. This definition presents vulnerability as factual exposure or susceptibility and resilience as the actual coping ability of systems (Christmann *et al.* 2014). From this stance, a system simply is in a specific way vulnerable or resilient due to specific, objective measurable external and internal factors (Holling, 1973). Since climate change perceptions of reality differ between different societies at different places and time, societies construct their distinct social reality of climate change. The social constructivist approaches adopted for this presents an avenue for deeper insights of vulnerability through particular cultural and social lens.

The social construction of disaster is gaining relevance in response to climate change impacts as the need to understand people's vulnerability and to explain disasters fully, become more pertinent (UN, 2010). Climate change uncertainty and fluctuating socio-economic conditions present new challenges for flood management that cannot be addressed by structural responses alone (Pahl-Wostl et al., 2008). As a result, mitigation and resilience planning as operational strategies in policies reflect a consensus about the need for adaptation. These constitute significant changes in the appreciation of complexities associated with flood risk management.

The considerations of future impacts of climate change are importance for a collective response as this could substantially increase environmental and social burdens (Leary, 2012; Schneider, 2002). According to Dessai *et al*., (2004) most scientific and policy discourse on climate change are based on subjective assumptions and assessment undertaken by "experts". Their study presents two contrasting perspectives of risk in what they termed as 'external' (based on scientific risk assessment) and 'internal' (based impacts experienced) and recommends an appreciation of both in policy responses. Strategies for management would need to consider social and individual perceptions of risk in developing sustainable responses. In contributing to social based understanding, Birkholz *et al*. (2014) argue for a re-examination of flood risk perception research in a manner underpinned by more constructivists thinking and for the development of the wider risk perception research.

1.2 Contextualising The Significance Of Locally Based Understandings Of Flood Management

Climate change impacts will differ globally. The assessment of climate change risks and appropriate coping strategies differ depending on cultural backgrounds and indigenous local practices (Christmann *et al*. 2014; Pareek and Trivedi, 2011; Mercer *et al*. 2010). These have implications for cultural and institutional context for individual and communities, as culture and tradition play important roles in the process of construction of knowledge and perception of climate change. Furthermore, acumens of vulnerability and resilience interweave with distinct cultural and social patterns of interpretation. Hence management responses need to consider the multiplicity of societal conceptions.

Although scientific literature and public policy documents attempt to predict, understand and plan for climate change adaptation at national and sub-national levels, much of the actual work on climate adaptation will necessary occur on the local levels (Mawdsley *et al*., 2009; Hughes *et al*.; 2003; Singh, 2003). Technological responses alone may not be able to cope with escalating environmental problems. In understanding that there are so many unknowns and uncertainty for future climate change, management is underlain by a culture of learning and understanding by identifying practical, sustainable strategies. It calls for integrations of social and environmental learning towards a new approach to environmental management that supports collective action. Social interactions as components of situated learning require the use of language to exchange and negotiate the meaning of ideas among communities.

The stimulus for learning communities comes from three broad bases: philosophical (learning communities fit into a changing philosophy of knowledge), research based (learning communities align with what research tells us about learning), and pragmatic (because learning communities work) (Cross, 1998). The social learning approach has three bases, to create learning platforms, learning platforms and learning ethics that support collective action towards sustainable planning. This view builds on the premise that social constructivism offers implications for social learning as collective action to improve the management of human and ecological interrelations. Social Constructivism views learning as a social process, with learning occurring when people work together. Collaborative governance is considered appropriate for integrated, and adaptive management regimes needed to cope with the complexity of social – ecological system.

The purpose of social science is to understand the social reality as different people see it and to demonstrate how their views shape the action which they take within that reality. It also emphasises the importance of culture and context in understanding what occurs in society and constructs knowledge based on this understanding. Social constructivism is a variety of cognitive constructivism highlights the collaborative nature of much learning. Constructivism invites the researcher to consider the ways in which social reality is an ongoing accomplishment of social actors rather than something external to them, and that totally constrains them (Bryman, 2012). The constructivist view proposes that consideration needs to be focused away from trying to ascertain 'objective conditions' through more data and better science, towards understanding the plurality of constructions i.e. How various assertions are

made, how these relate to the different interest of stakeholder groups and how power relations affect outcomes. With this understanding, this research maintains that areas of social constructivism are perfectly capable of dealing with environmental change and could lead to highly fruitful analysis. Social constructivism centres on everyday interactions between people and how they use language to construct their reality. In an attempt to make sense of the social world, social constructivist view knowledge as constructed as opposed to created and where society exists as both a subjective and objective reality (Andrews, 2012).

In line with modern environmental management literature, community involvement is now seen an indicator to monitor progress towards sustainable development and environmental management goals in line with adaptation (IPCC, 2012; UNFCCC, 2007). Thus, the effectiveness of strategies for adapting to climate change depends on the social acceptability of options for adaptation, the institutional constraints on adaptation and the place of adaptation in the wider landscape of economic development. Community engagement and multi-stakeholder solutions in FRM is increasingly important for success in delivering flood management strategies. Without effective engagement and communication with both professional and community stakeholders, flood risk science could fail to translate into practical management. It is against this understanding that this research seeks to understand what makes flood risk communication work effectively within communities for NFM applications.

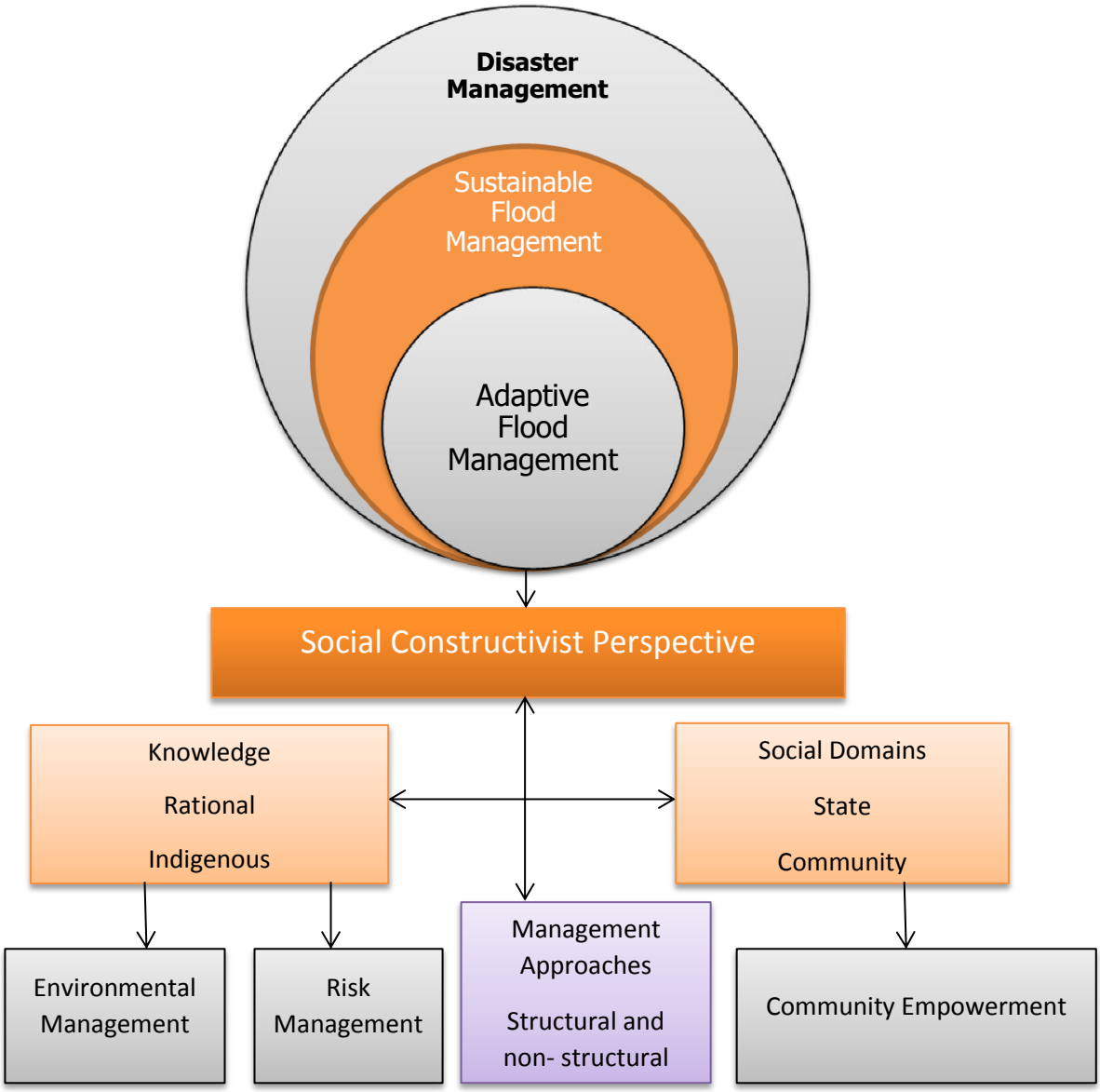

Figure: 1.1 Conceptual models based on a social constructivist perspective

Source: author

1.3 NFM as an Adaptive Management Response

Natural Flood Management (NFM) defined as "a set of flood management techniques aims to work with natural processes (or nature) to control floods risk" (Blanc *et al*. 2012). The inclusion of ecosystems and their services into flood defence schemes is a rapidly growing field in adaptive management of

floods (van Wesenbeeck *et al.* 2016). NFM methods include the restoration, enhancement, alteration of physical features and characteristics (SEPA, 2015). In this leaning towards adaptative responses, NFM is currently promoted as a part of Sustainable Flood Management (SFM), and also as a cost-effective catchment scale approach for flood mitigation in the short and long term. The Scottish government takes SFM to mean planning at basin levels, incorporating a broad range of measures to reduce flood risk. An assessment of NFM contributions in flood mitigation is required under the Flood Risk Management (Scotland) Act 2009. However, NFM requires different designs, construction and management methods bespoke to local conditions. Furthermore, technical expertise from engineers, ecologist and public administration alongside collaboration between communities, farmers, landowners is crucial to its success. This technical /social collaboration understanding presents unique challenges in terms practical application.

The adaptive capacity of actors involved in flood risk management in the UK to seize the opportunities from NFM is considered to be minimal (DEFRA, 2013). For individual players, adaptive capacity varies, key agencies such as (SEPA, EA) play a crucial role in structuring the approach to flood management, including NFM contributions. Still, the range of relevant associated organisations each has its objectives, which in some cases do not align with others. Given the reliance on land to deliver NFM measures, land owners/ farmer "buy-in" is crucial for success. Community cooperation for NFM was researched by Howgate and Kenyon (2008), Woodley (2013) and other researchers. These authors highlight a key factor in the successful transition towards a non-structural approach to FRM to be the role of stakeholder engagement. Woodley

(2013) also noted traditional approaches disengage and disempower stakeholders' responsibility for flood management. He accredited to centralised and generalised top-down management practices which fail to account for indigenous stakeholder knowledge and opinions in management practice. Therefore, there is a prerequisite for understanding stakeholder participation within FRM: promoting community resilience towards the transfer of risk responsibility from central authorities to stakeholders. Some UK NFM case studies, such as Eddleston, Tarland, Allan and Spey catchments, are taking proactive steps and promoting greater integration of communities in environmental management.

Support of NFM is growing at the local, national and international levels in line with sustainability aspirations and its wider benefits acknowledged (Postel and Richter, 2012; Iacob *et al.* 2014). The scientific field of NFM is a valid solution for managing flood risk while offering significant multiple benefits (Nicholson et al., 2016). Evidence from well-implemented NFM shows its effects on restoring natural catchment hydrological and sedimentological processes, which in turn has significant flood risk benefits for catchment waterbodies (Nicholson *et al.*, 2012; Gilvear *et al.,* 2013; Bergfur *et al.,* 2012). However, there are still gaps in the technical understanding of NFM and the management structures required to implement them (Johnson *et al.,* 2008; Johnstonova, 2009; DEFRA, 2013). Hence, there a need to investigate opportunities for NFM within the current policy climate and investigate its feasibility for future applications.

1.4 Significance of the Research

The need for a new understanding of how stakeholder participation could enhance positive benefits to individual and community resilience within SFM is crucial in the light of climate change threats and scientific reliability concerns (Denton *et al.* 2014). Recent flooding in the UK has resulted in significant policy changes: for example, the Pitt Review commissioned after the floods of 2007 reiterate the need for adaptive planning and use of non-structural responses (Pitt, 2008). Adaptive planning and economics of climate resilience are also changing with a policy focus on identifying and assessing barriers to effective adaptation actions and seeking to understand drivers of behaviour which hinder or promote the adoption of adaptation actions (IPCC, 2012). Within this social – ecological context, this research aims to contribute by addressing questions concerning the scientific understanding of CC and cognitive process in the application of NFM. This study adopts the social constructivist approach in highlighting some aspects are shaping global climate change discourse and in understanding adaptation as a social process. For instance, sustainable development or historical responsibility may be understood differently by different actors, which in turn manifests itself within negotiations over climate change policy (Pettenger, 2007). Constructivism argues that 'the material and ideational are complexly interwoven and interdependent'. The implications mean society creates social contexts in which meanings are constantly defined and redefined (Andrews, 2012). The study considers case study methodology in two locations in Scotland and Nigeria. It investigates the legal and institutional complexities associated with NFM planning in Scotland; stakeholders

collaboration for NFM planning and the feasibility of NFM approach for adaptive management in Taraba, Benue Valley Nigeria.

The results of the thesis will be of interest to local authorities, environmental regulators, researchers with interests in multi-disciplinary approaches for flood mitigation and environmental management in both Nigeria and Scotland. Figure 1.2 presents the research plan.

1.5 Research Aims and Objectives

The purpose of the study was to examine NFM applications as an adaptive management response to flood risk in Scotland. The research also considers a bottom –up initiative about climate policy for the Nigerian case study, which identifies local partnership needed for NFM application.

AIM

- To develop a collaborative stakeholder strategy using NFM applications for flood mitigation in Nigeria (Africa).

OBJECTIVES

- To determine the fundamental principles of NFM and its importance in flood control.
- To identify best practices (based on UK practices) and factors affecting development and application.
- To determine current practices in Taraba state and identify key issues that would make a difference in flood management.
- To propose an appropriate methodology for NFM applications in Taraba, Nigeria**.**

1.6 Research Design

A multiple case research methodology was used to achieve the study aim. The study structured into three phases:

- Investigating NFM applications adopted in three catchment studies (Eddleston, Allan Water and Upper Clyde).
- Examining stakeholder partnerships/ platforms for NFM applications in five further catchments (Tarland; Spey (Feshie & Dulnain); Belford and Derwent).
- The third phase evaluated the research output potential application in the Benue Valley (Nigeria).

The following section presents the thesis structure, shows how the research developed and reflected the key aims and objectives of the study.

Chapter 2 presents the development of sustainable flood management concepts showing Current Sustainable Development Policy and Implementation, Integrated Catchment Approach to Flood Management Adaptation, Flood Risk Management (FRM) in Developed and Developing Countries and finally a review of Natural Flood Management applications covering: Key principles of NFM and its relevance in flood management; evidence base and best practice examples and key environmental challenges for NFM and adaptive management responses in sub-Saharan Africa.

Chapter 3 presents theoretical and conceptual framework adopted for the study.

Chapter 4 offers flood management approach in Nigeria, sub-Saharan Africa, with a focus on social dynamics and cultural practices in Taraba, Nigeria. The section also presents background synopses of physical characterises, current management situation, institutional management framework, flood management strategy and the potential for NFM application for flood mitigation.

Chapter 5 presents a conclusion of the literature

Chapter 6 presents the research methodology. Investigating the steps, strategies and conceptual framework generated after understanding the gaps in existing knowledge. It also presents the theoretical approach and study design. Multiple case study design is used to develop a methodology to implement this conceptual understanding and the social constructivist approach is adopted.

Chapter 7 presents Scottish case study descriptions; identifying themes from the first and second phase of the research. The methodology described in Chapter 6 provided the baseline for data gathering.

Chapter 8 investigates inter-agency collaboration and flood management procedures in Taraba state: exploring the feasibility of promoting NFM as a sustainable option for flood mitigation through a case study/ interview methodology as presented in chapter 6.

Chapter 9 presents a synthesis of research findings, examining the interrelationship between NFM, stakeholder engagement and community adaptation potential for SFM.

Chapter 10 summarises the research: presents the empirical findings, theoretical implications, research limitations and recommendations for the proposed NFM framework application.

1.7 Schematic Research Plan

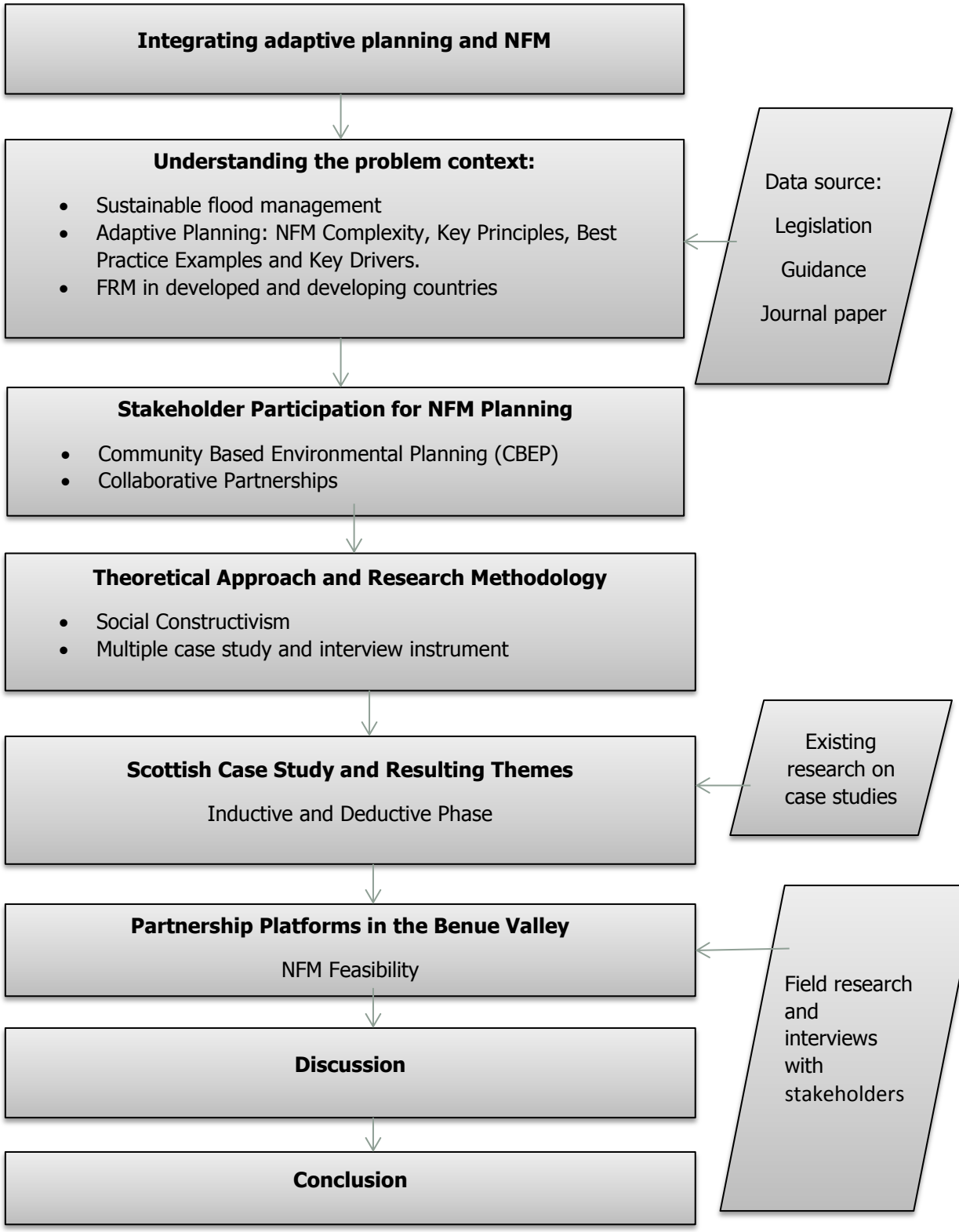

Figure: 1. 2 Schematic Research Plan

CHAPTER 2

2. SUSTAINABLE FLOOD MANAGEMENT: SHIFTS TOWARDS HOLISTIC AND ADAPTIVE MANAGEMENT

2.1 Introduction

This chapter reviews sustainable flood management concepts focusing on the paradigm shift towards adaptation. NFM complexity and interconnected factors associated with the application. It also considers adaptive responses in sub-African Africa. This chapter presented in the following order: Section 2.2 provides a review of the literature on policy and institution changes towards sustainable flood management. Section 2.3 & 2.4 presents NFM as a part of management response, outlining best practice examples and NFM practicalities. Section 2.5 explores adaptive management's initiatives in sub –Saharan Africa, identifying challenges to the application. Section 2.6. Considers initiatives tailored and aimed at promoting adaptive approaches. Finally, Section 2.7 presents the chapter summary.

2.2 Sustainable Flood Management (SFM): From Defence to Management

The Brundtland Commission define their vision for sustainable development in ' Our Common Future' (World Commission on Environment and Development 1987) to be "development that meets the needs of the present without compromising the ability of future generations to meet their needs" (WCED, 1987, p. 43) (see figure 2.1). The remit of the report was to investigate concerns raised about negative impacts of human activity on the planet and also the unsustainable pattern of development if left unchecked. The concept of

SD received its first major international recognition at the UN Conference on the Human Environment held in Stockholm in 1972, where it was agreed that both development and environment could be managed in a mutually beneficial way (Redclift, 2005). The Rio+20 United Nations Conference on Sustainable Development held in 2012, was the first major UN sustainability conference in a decade. The expectations were that global leaders could reach an agreement, with binding treaties on limiting environmental damage and fostering sustainable development (Tukker, 2013). The outcomes were a non-binding "Declaration" that some critics consider unsuccessful because it failed to lay out a coherent roadmap nor establish binding requirements towards global sustainability (Bulkeley *et al.*, 2013; Biermann, 2013; Ely *et al.*, 2013; Bernstein, 2013). Many believe it side-lines important questions relating to the future of sustainability. Part of the criticism highlights the inability of the declaration to reflect changing political reality in international negotiations. Clémençon (2012) also noted that consideration not given to developing countries for whom poverty eradication is currently an overarching priority more than at any time before.

The Brundtland Report's definition of sustainable development is the most widely used by scholars and practitioners (Sneddon *et al*. 2006). However, the application of sustainability principles to flood management remains varied and insufficiently answered. Huang (2012) in his opinion argues that sustainability in flood management must find a balance between flood protections for the present generation while leaving a sufficient degree of freedom to future generations. His reasons being that we currently do not know what generations to come would want or value, what technologies generations to come will have,

and in particular, he noted that some of the today's management objectives and practices may be wrong or may change over time. For this reason, consider flexibility or reversibility as a minimum requirement for SFM. He further suggests a new strategic concept termed as "Flood Sharing" as a means towards sustainable flood management.

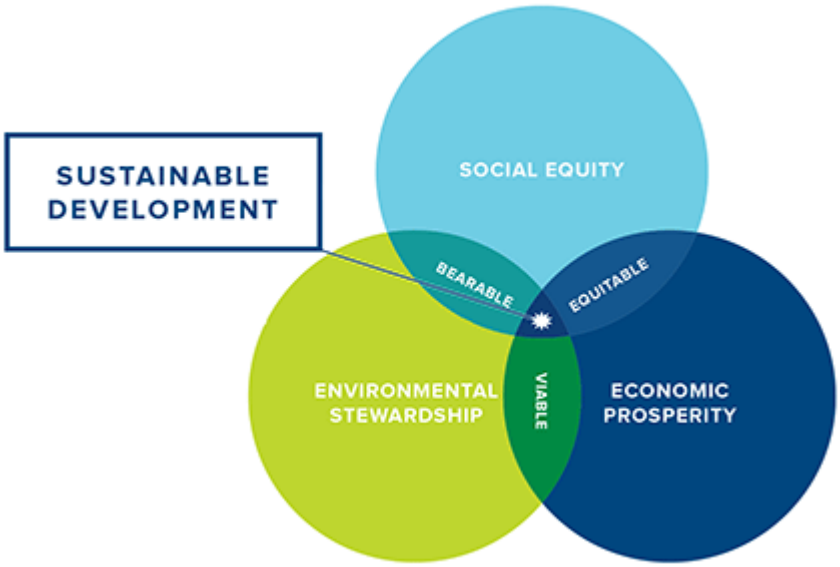

Figure: 2.1 Components of Sustainable Development

Source: MDG's (2015)

However, sustainability as a concept in flood risk management is not without criticism. FRM is often seen as a complex issue not definable in practice (Ison et al., 2007; Loorbach, 2007; Butler and Pidgeon, 2011). Disaster risk for management assessments bases on calculations of the possible economic, social and environmental consequence of a physical event in a particular place and time. However, the risk is hard to conceptualise comprehensively (Cardona, 2004). Hudson and Vissing (2013) argue the concept has been over generalised and has become a buzzword masking different agendas. He further emphasises

the idea ignore insights of the newest generation of system theory on complex systems on the ubiquity of far from equilibrium conditions. Banerjee (2003) explored the contradictions inherent in the SD debate. He argues that SD discussions be mostly based on economic foundations and not on environmental grounds and rationality, a discourse which embodies a view of nature specified by modern economic thought. He believes the prudent management of resources is integral to the western economy, but its imposition on developing countries would be problematic. However, the development of sustainable management strategies has the potential to address flooding challenges for now and in the future by identifying vulnerability and adaptation possibilities within the social, economic and environmental sectors. The primary goals of FRM strategies presented in Figure 2.2.

Sustainable Flood Management (SFM) is moving up policy agenda as a consequence of climate change impacts, adherence to EU Water Framework Directives and EU Directives. Accordingly, protection has changed to a societal flood risk management and a new approach to sustainable development that takes into account complex interaction between the climate, social and ecological systems (IPCC, 2014). Denton *et al*. (2014), argue flood management strategies be expected to explore "climate resilient pathways" as developmental trajectories that combine adaptation and mitigation to achieve the goal of sustainable development. Adaptive process is iterative and continually evolving for the management of change within the compound system of flood mitigation. Therefore, FRM depends on the collaboration of professionals in different fields; entails the consideration of where floods are

likely to occur and methods for risk reduction without transferring the problem elsewhere.

This shift from policies of "flood defence" to flood "flood risk management," entails a more holistic approach to management, change in strategy, advocacy for flexible approaches and greater participation of private citizens (Butler and Pidgeon, 2011) (see figure: 2.3). Within the Scottish context, the Scottish executives use it to deliver the four as Awareness + Avoidance + Alleviation + Assistance (Scottish Executive 2005). The four A's aims to integrate short and long-term requirements in line with local and global prerequisites. The Scottish Government set out five outcomes in delivering Sustainable Flood Risk Management in June 2011.These includes:

(i) A reduction in the Potentially Vulnerable Areas (PVA) by targeting mitigates efforts in areas at greatest risk.

(ii) The utilisation of rural and urban landscapes for excess flood storage.

(iii) Integrated drainage to reduce flood risk and improve water environments.

(iv) Public education on flood resilience.

(v) Sustainable and adaptive flood management actions.

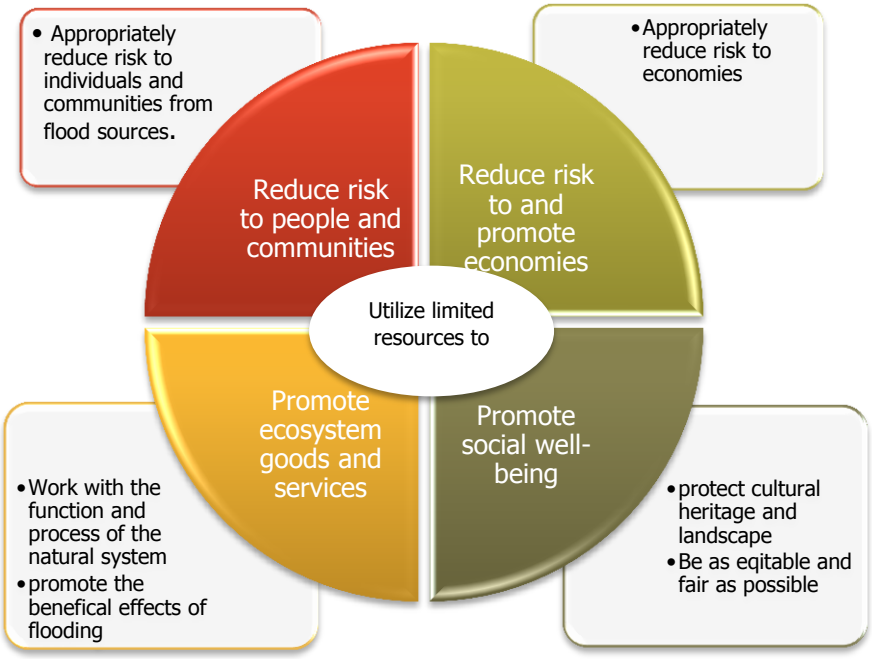

Figure: 2.2 Primary Goals of Strategies for Flood Risk Management

Source: Sayers *et al*. (2013)

2.2.1 Current Sustainable Management Policy Strategies

Sustainable development is a complex and multidimensional subject; which combines efficiency and intergenerational equity based on the economic, social and environmental aspects. Thus, a cardinal part of the United Nations Conference on Environment and Development (UNCED) process is to bring together major social actors for joint cooperative synergies on vital issues of environment and development efforts. The entire Section III of the Rio 'action plan'- Agenda 21 is devoted to strengthening the role of the main groups. In an acknowledgement that SD will require new forms of social learning, where collaborative partnerships would seek to resolve conflicts on environmental and developmental issues (Lafferty and Eckerberg, 2013; Dahl, 2014)).

To tackle SD complexities, the European Union adopted the EU Flood Directive (2007/60/EC) in 2007. This Directive requires flood risk assessments, flood risk management plans and the involvement of stakeholders in the implementation process of the Flood Directive as a new approach in FRM. Stakeholders have begun to implement these initiatives. For example, the 6th International Conference on Flood Management (ICFM6) changed the conference title from "Defence" which was used in the previous five events to "Management," which is reflective of the more holistic and integrative approach to flood management and a paradigm shift towards sustainability. Similarly, to other areas of environmental management, such as river basin management and urban development projects, FRM identifies stakeholder involvement and participatory approaches as central to its efficient and sustainable implementation. (Figure 4 shows the various drivers of SFM).

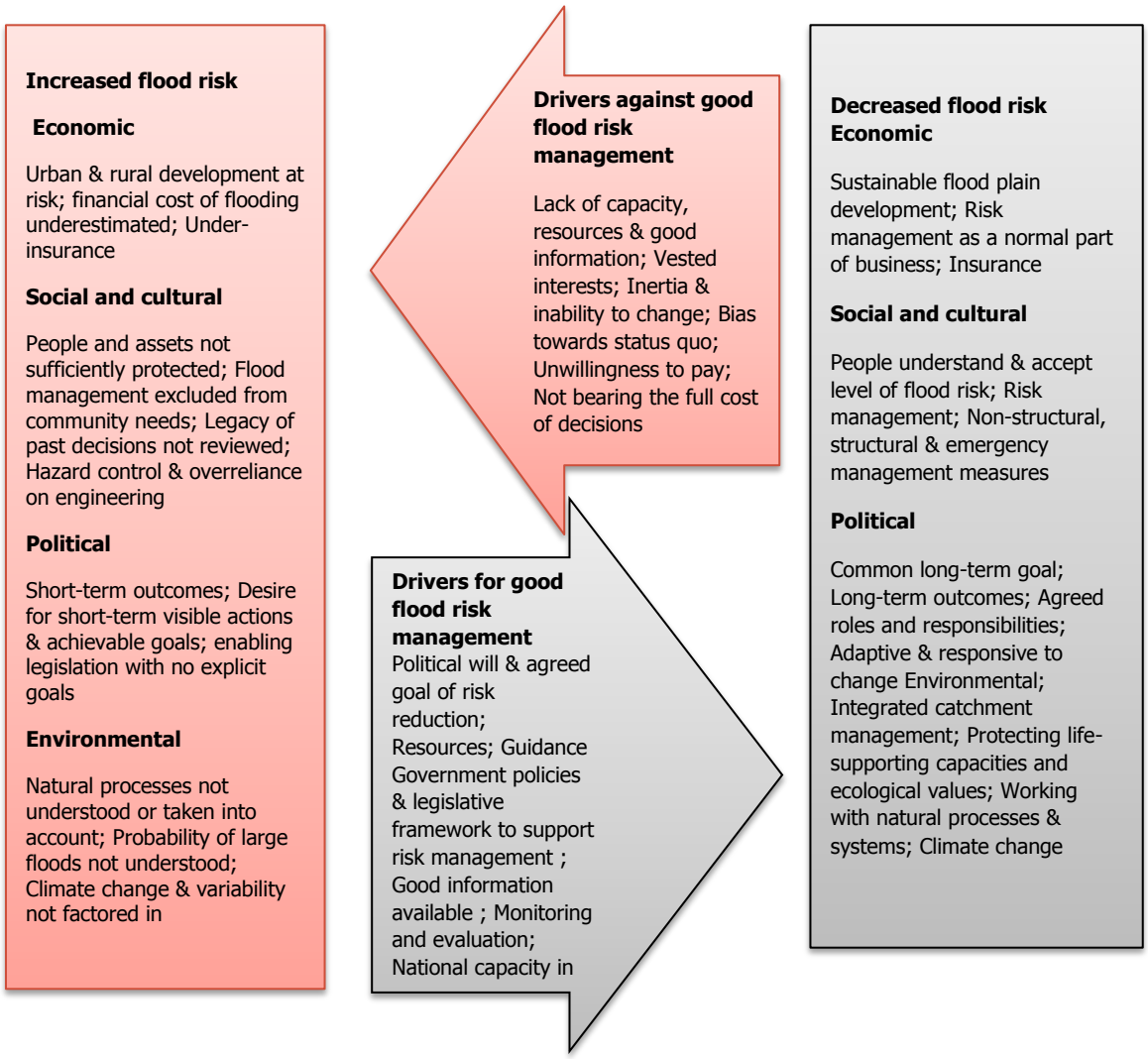

Figure: 2.3 Drivers of FRM

Source: Adapted from Ministry for the Environment New Zealand (2008).

2.2.2 Integrated Catchment Approach to Flood Management

Nexus thinking in the form of integrated catchment management argues for holistic and better transition towards sustainable development. In the EU, the Water Framework Directive (WFD) introduces the principle of integrated river basin management. This framework incorporates the idea of spatial fit between ecosystems, social systems and a requirement to embrace water management

across scales and sectors. In designing their implementation setups, Member States are expected to address both the roles of different institutional actors and the interplay among institutions. However, conflicting aims and a lack of integration and cooperation in planning and management could be detrimental to sustainable management. Evers & Nyberg, (2013) examined the coherences and inconsistency of European instruments for integrated river basin management. They noted that land use and water management were treated as two different concerns within planning procedure and decision – making processes.

The integrated catchment approach in Scotland is fully embraced. In compliance with the EU WFD and EU Floods Directive, the Scottish Government reviewed its River Basin Management Plan (RBMP) strategy to enable a new focus on institutional arrangements and processes which include stakeholder's collective ownership of problems and solutions. This approach acknowledges the various pressures on the water environment and the implementation of a stakeholder engagement process. It seeks to create a platform where local communities would build partnerships to implement local actions with emphasis on improving management. For example, the Scottish legislation requires a whole catchment approach to flood management. Current laws are primary drivers towards the shift to SFM which has been in practice in Scotland. The Water Environment and Water Service Act 2003 imposed this duty on Scottish Ministers, SEPA, and responsible authorities. The enactment of the Flood Risk Management Act (Scotland) 2009 further enshrouds duties on SFM in law. Section 20 of the Act, requires SEPA to undertake an assessment of the possible contributions of NFM strategies to managing flood risk in Scotland.

These include the restoration of wetlands, floodplains, forest cover, woodlands and other features that either store water or slow its flow downstream towards areas that are at risk of flooding.

Kenyon *et al*., (2008) researched the role of agriculture in sustainable flood management. They highlight the potential for agriculture to become part of solutions towards FRM while noting the few existing institutional links between FRM and agriculture. They also noted the lack of scientific concepts addressing governance and cultural adaptation within the processes of culture and social learning for environmental resource management.

2.2.3 Stakeholder methodologies in environmental management

Community engagement and multi-stakeholder solutions are now basic requirements for environmental management and are seen as an indicator to measure progress towards sustainable development (Bezanson and Isenman, 2012). Stakeholder analysis is particularly relevant for the analysis of natural resource management where issues are characterised by cross- cutting systems, stakeholder interests and multiple uses (Reed *et al*. 2009). The process recognises the different stakeholders involved in the utilisation and conservation of natural resources and provides tools that help to identify and resolve trade-offs and conflicts of interest. Stakeholder analysis in natural resource management stemmed from concern that many projects fail to meet their stated objectives because of non-cooperation from key stakeholders (Burgha and Varvasovszky, 2000). Management aspirations reach beyond purely 'scientifically' or 'technologically' based solutions to encompass contributions to a broader set of societal goals, inducing those focussed on environmental and social responsibility imperatives. The challenge herein is to

develop and implement improved methods of aiding decision-making processes under multi–stakeholder and inter-organisational settings across spatial and administrative scales, all the while adapting proactively in the face of future challenges.

Stakeholder engagement evolved in response to a drive for greater efficiency and consistency in publicly funded environmental decision making alongside regulatory requirements for more engagement with interested parties and the public. Policy and legislative requirements at local, national and international management spheres are reflective of this shift (e.g. Water Framework Directive, Arhus Convention and local planning frameworks). This change anchors from the broader community and multiple agencies involved in flood risk management governance as management strategies draw on a much wider portfolio than before. For this reason, stakeholder participation in environmental decision-making has been increasingly sought and embedded into national and international policy (Reed, 2008; Stringer et al., 2007).

The promotion of participation is credited with increasing public scepticism about science, knowledge and in environmental decisions (Irwin's (1995). "Citizens' science" and ongoing policy trends that underscore sustainable development and partnership are working approaches, fundamental to environmental management (Younge and Fowkes, 2003; Richards et al., 2004). Furthermore, decisions on flood vulnerability are made within social-cultural contexts, the successes of management strategies are also determined by the nature of values that impact on the decision-making process. Given extreme weather variability, a robust management approach must give precedence to

adaptation and mitigation strategy in its programme to enable society to cope with climate change.

Stakeholder participation is essential within multi-sectorial, cross-border and multilevel groups. However, collaboration on future change requires structured and more permanent networks. Previous studies show evidence of its potential to enhance the quality of environmental decisions. This could be attributed to significant information inputs. However, the quality of decisions made through stakeholder participation is strongly dependent on the nature of the process leading to them. Where relevant, stakeholder involvement should be considered as early as possible throughout the process; the objectives, and for the participatory process needs to clarify from the onset. Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement.

2.2.3.1 Participation: The European Perspective

The concept progressed through a series of distinct phases: from awareness raising in the 1960s (Tatenhove and Leroy, 2003) ; incorporating local perceptions into planning, where participatory approaches developed in part, as a response to the top-down, science-led transfer of technology paradigm in the 1970's (Pretty, 1995); the development of techniques that acknowledged local knowledge and encouraged participatory rural appraisal in the 1980s; the adoption of participation as a norm in the sustainability development agenda in the 1990s (e.g. UNCED, 1992); a critique of the limitations and drawbacks of the participation in 2000 (Cooke and Kothari, 2001); and finally to the cross-disciplinary approach and learning alliances (Sabastiaan et al, 2011; SWITCH PROJECT). With each change of regime, law and management systems have

been adapted, up until the current system of specific legislation and administration systems developed by each national government in Europe.

Public participation is a fundamental element of integrated water resource management. One of the major objectives of the Water Framework Directive is to achieve 'good' ecological status for rivers and also dictates that management must take place at water-basin scales and also incorporates public consultation and involvement (EU, 2006). Still how this requirement could be read and transferred into practice is far from evident. (Ker Rault & Jeffrey, 2008; Reed, 2008). Currently, participatory approaches are broadening to include more visions and interpretations of the problem situation. The promotion of participation can be credited to increasing public scepticism about science, knowledge and interest in environmental decisions (Irwin's (1995) ''citizens' science'') and ongoing policy trends that underscores sustainable development and partnership working approaches as fundamental to environmental management (Younge and Fowkes, 2003; Richards *et al*. 2004).

Understanding the nature of risk and uncertainty is an important part of the scientific understanding needed for public policy issues and everyday decisions (Irwin, 1995). Engagement focused on controlling stakeholders and managing risk is valuable, but not sufficient to achieve excellence in sustainability. Engagement and collaboration with parties concerned can lead to learning, innovation and fundamental corporate transformation (Sloan, 2009). A further key point refers to the societal management process itself. To this point, stakeholder engagement in environmental management is entrenched into national and international policy.

2.2.4 Management Approaches In Developed and Developing Countries

Flood risk management approaches differ between developed and developing countries. In developing countries, the weak institutional capacity to deal with risks means flooding is a major and acute environmental hazard. Accordingly, developing countries appear to suffer a disproportionate impact of flood hazards (Michel-Kerjan *et al*., 2013). For example, Asia suffers more than 50% of the damages from flood hazards globally (Tingsanchali, 2012). In developing countries management of flood, disasters are reactionary and largely in the hands of the government who are responsible for flood disaster management which includes flood risk assessment and preparedness (Tingsanchali, 2012). The failures of flood risk management translate into the numbers of persons affected. Over 90% of the victims of disasters such as flooding are from developing countries and the risk factors change over time on account of enablers such as climate change (Michel-Kerjan *et al*., 2013). Also, increasing population pressures in developing countries increase the flood risks (Lempert *et al.,* 2013). It implies that flood risks enablers are increasingly sophisticated and often beyond the capacity of the local government to handle. There is a mutual relationship between disaster risk and development. Evidence show repeated disasters undermine long-term socio-economic objectives, and competitiveness (Keating *et al*. 2014). Clearly evident in low-income developing countries where disasters hamper development processes. In many developing countries livelihoods are intrinsically linked to natural resources (Dent et al., 2013). The majority of settlements are along river courses, thereby increasing the potential for flood-related loss of property, life and important crops.

In developed countries, there are significant differences in how flood experiences are observed, experienced and what strategies are applied to manage occurrence (Hegger *et al.,* 2013). However, despite significant investments in flood risk management, flood risks still exist in developed regions like Europe (Kundzewicz *et al.* 2014). In developed countries, approach to risk management is through an integrated strategy. For example, in Rotterdam governance approach to flood risk is a successful integration of the multilevel governance and spatial planning (Ward *et al.* 2013). In the Netherlands, which is one the most flood-prone countries in the world, the country has embraced long-term planning employing innovating, testing, improvement and adoption in a learning approach (Zevenbergen *et al*., 2013). Furthermore, there has been a coordinated and cooperative policy and legal approach to tackling flood risk management in developed countries. For example, the Flood Risk Management Directive in 2007 adopted by the European Union (Müller, 2013). This cooperative approach is a critical success factor in flood risk management in developed regions of the world. The successes of the cooperative approaches are expected because international cooperation and cross-border learning are essential in improving flood risk management (Müller, 2013; Zevenbergen *et al.,* 2013). Also, improved governance and integrated management responses make fundamental differences between the success and failure recorded in developed countries and developing countries.

Many developing countries tackling flood risks by committing resources to reduce their risk exposure. For example, in Asia improving financial capacity has caused a positive change in investments in flood risk management

infrastructure (Kundzewicz *et al*. 2014). Moreover, countries such as Indonesia have a heightened political discussion of the flood risk management and long-term planning initiatives in that direction (Ward *et al*. 2013). Despite these positive moves, the policy initiatives to successfully tackle flood risk management are still lacking in developing countries. The gap between strategic initiatives and implementation continues to be a major hurdle for the successful mitigation of flood risk management. As Ward *et al*., (2013) observes adoption by players in the main sectors like housing, transportation and economic development is the way to connect policy and implementation and therefore improve the potential for policy implementation. The inappropriate attention to flood risk management in developing countries viewed from the standpoints of the overwhelming desire for economic progress to the detriment of what is perceived as peripheral environmental issues. In other words, the focus is largely on development which fails to link environmental issues to sustainable economic growth. However, as Lemos *et al*. (2013:14) notes "growth focused development outcomes can sometimes reduce the ability to cope with risks".

The conceptual understanding of FRM results in changes to decision-making practice. It highlights risk management as potentially more complex, but more efficient and effective in delivering multiple goals for FRM; than a traditional engineering standards-based approach (Sayers *et al*. 2013). The "whole thinking" approach is its main advantage and a prerequisite for more integrated and informed decision making where it seeks to improve the public dialogue around flood resilience. The historical development and emerging trends in FRM strategies have developed because of cultural processes unique to individual

countries. Findings show major flood disasters are usually followed by policy changes in light of new scientific insight, public opinions and new power alliances (Samuels *et al.*, 2006).

Figure: 2.4 Flood Management Dilemmas

Source: Researcher illustrations

The transfer of technical knowledge, policy initiatives, experience and technology from the developed countries to developing countries is an important means to help build capacity in developing countries. However, the transfer of the successful strategies for flood risk management from the developed to the developing countries poses significant challenges. Zevenbergen *et al.*, (2013) posits that it will require major institutional changes throughout the levels of management and bespoke institutional change projects on the part of developing countries. Such whole scale changes are not easy to

implement due to fundamental differences in structure and systems. These constitute major obstacles to adoption of successful strategies from developed countries to developing countries. Figure 2.4 show a comic representation of flooding realities in developing and developed countries.

2.3. Natural Flood Management: Adaptive Response

NFM defined as the "alteration (including enhancement), restoration or use of landscape features to reduce flood risk", is a catchment-based approach designed at reducing runoff rates in the uplands and reducing rates of flow down watercourse. Practical applications of NFM techniques require transboundary collaborations and rely on community cooperation (Howgate and Kenyon, 2008). The key components of NFM encompass a suite of techniques applied around the catchment. The quantification of their effectiveness in the short and long terms are dependent on some factors such as location, the intensity of flow and soil conditions (Biesbroek *et al.*, 2009).

In Scotland and under the FRM Act, SEPA is responsible for assessing the contribution of NFM to managing flood risk. The assessment often referred to as 'Section 20 Assessment'. It is a high-level nationwide implementation scheme to identify areas within catchments where NFM could potentially reduce flood risk. The outputs identify actions to be taken to manage the risks. Subsequently, NFM's potential is evaluated against and in combination with other measures with the aim of identifying the most sustainable pathways to flood mitigation (Johnstonova *et al.*, 2012).

2.3.1. NFM Principles and Its Relevance in Flood Management

Key objectives shared by the EU countries and the implementation of the 2007 Floods Directive played a major role, in reducing flooding impacts and economic losses and contributing to strategic planning towards better environmental management. The UK Foresight Future Flooding project's long-term (30year-100 year) vision for flood and coastal defence considers numerous uncertainties and is used as a basis to inform policy and delivery (Penning-Rowsell *et al.*, 2013). The growing importance of river restoration and floodplain management for flood risk necessitated the establishment the European Centre for River Restoration (ECRR) as an international network for dissemination of research and the provision of a wealth of useful information for future studies. As a result, the new strategic direction is currently being taken forward across member states and relevant agencies. Examples include the establishment of a European Centre for River Restoration in 1995 as a centre for a Europe-wide network for exchange of knowledge and best practice.

The Water Framework Directive, Habitats Directive, Environmental Impact Assessment and Strategic Environmental Assessment Directive apply sustainable approaches to water management by setting out requirements for basic water needs while protecting the environment. According to Morandi *et al.* (2014), the implementation of WFD has significantly influenced the growth in the number EU river restoration projects. River restoration, which aims to meet the EU Water Framework Directive (WFD) (2000), is a major practice in river management (Brierley & Fryirs, 2005 and Wohl et al.,2005).

NFM measures vary with functions (e.g. run-off reduction, flood attenuation or desynchronizing floods), the type of flood they address (e.g. fluvial, pluvial or coastal) and wherein the catchment they are usually used (e.g. upper, mid or lower). (See: Table 3.1). Also, the uses of some NFM techniques are particular to specific locations (uplands, rural, urban, and coastal). Techniques range in potential scale from local to regional, and their appropriateness will depend on the magnitude of the risk to managed, and the benefits sought (EA, 2010). Flood prevention measures entail a more natural flood management approach to achieve common benefits such as avoided costs of damage to society, human health, economic activities, infrastructure, cultural heritage and the environment. However, this approach allows land to deliver multiple benefits such as:

- Restoring natural flows by realignment of coastal areas, or re-connection of rivers with their floodplain.
- Restoration of wetlands which can store flood water and help "slow the flow" of flood waters.
- Reservoirs in agricultural areas can store flood water during flood events, and otherwise be high nature value zones.
- Urban Green Infrastructure such as green spaces, sustainable urban drainage and green roofs.
- Maintaining and restoring biodiversity, by strengthening the functionality of ecosystems.

- Provision of nature protection areas which can also be valuable for recreation and increase life quality.
- Improving water quality and restoring water resources.
- Contributing to the development of a green economy by providing jobs and business opportunities in addition to environmental advantages (EU, 2011).

2.3.2 Evidence Base for NFM Practices

Most of NFM techniques are components of different practices in farming, forestry, river restoration and habitat management (Johnson, 2008). In exploring the practice and theory of agriculture, interdisciplinary analysis of agriculture and field- based experiential learning could provide multi- benefits for flood reduction.

2.3.3 Upland Forestry

Forestry cover has an effect on runoffs and flooding. Price and Butt (2000) research undertaken in North America reports a 100% cover of the mature forest was likely to reduce flood flows, typically in the range of 5-35%. These are also subject to a range of factors such as soil conditions, infiltration rates, and interception losses during event and topography. In another study, Siriwardena *et al*. (2006) report on the effects of deforestation on a 16,500 km^2 of nature forest in Queensland. The study shows increased runoff rates of about 40%.

2.3.4 River Channel Restoration

In the UK, the River Restoration Centre (RRC) has pioneered several river restoration projects. These projects indicate benefits for flood mitigation. Examples include: (i) River Quaggy (River Restoration Centre, 2008) where reintroduction of floodplains as a natural storage area for flood alleviation plan ; (ii) Rivers Cole, Skerne and Brede (EU-LIFE project) where meanders were restored to re-create the natural flood regimes (River Restoration Centre, 1999); and (iii) large woody debris was used to influence the rate of flow in the river channel at the River Devon catchment (McOuat, 2005).

2.3.5 Wetlands and Floodplain Management

Various studies show the effectiveness of wetland /floodplains in flood management. Bullock and Acreman (2003) presented evidence on the effectiveness of floodplains from an analysis of 169 quantitative studies. Johnson et al., (1991) presented a case study in the River Spey catchment where the floodplain was used as a natural flood buffer to protect downstream communities and provide additional biodiversity benefits. In the Upper Drava River in Austria (EU LIFE funded the project) where the flow velocity reduced and flood storage enhanced by the restoration of the floodplain (WWF, 2002).

2.3.6 Riparian Vegetation

Riparian vegetation and woodland lead to increased hydrological roughness which slows river flows, especially during flood conditions. (Johnson, Watson, McOuat, 2008). Several researchers have examined the effect of riparian vegetation in water flows and discharge. Thomas and Nisbet (2006) modelled the effects of floodplain woodland over a 2.2 km reach of a river in southern

England and reported a reduction in water velocity. Anderson et al. (2008) established the contributions of riparian vegetation to enhancing local flood generation while mitigating floods at a catchments scale. Darby (1999) devised a model to test the effects of flexible and non-flexible vegetation on flow resistance.

2.3.7 Agriculture

Rural land management methods can potentially affect flood generation by influencing the infiltration rates or runs off as overland flow (O'Connell et al., 2004). Robinson (1990) establish a relationship between drainage rates with soil water status and Morris & Hess (2007), explored the possibility of mitigating flood risk by the adoption of specific measures that could reduce runoff and retain storm water on farm lands. Similarly, flood risk management within the upper catchment of Nant Pontbren was informed by a farming community initiative to improve the sustainability of their land management practices (FRMRC, 2008). The recent drive towards the adoption of NFM techniques has already led to some initiatives aimed at assessing and promoting the most widespread implementation of NFM techniques within Scotland. Although some obscurities remain, regarding the effectiveness of NFM measures at the catchment scale but never the less these initiatives have helped improve the evidence base of NFM performance, design and implementation. (Blanc *et al.*, 2012).

2.4 NFM Practice In The UK

NFM defined as the "alteration (including enhancement), restoration or use of landscape features to reduce flood risk", is a catchment-based approach

designed at reducing runoff rates in the uplands and reducing rates of flow down watercourse. Practical applications of NFM techniques require transboundary collaborations and rely on community cooperation (Howgate and Kenyon, 2008). The key components of NFM encompass a suite of techniques applied around the catchment. The quantification of their effectiveness in the short and long terms are dependent on some factors such as location, the intensity of flow and soil conditions (Biesbroek *et al.*, 2009).

In Scotland and under the FRM Act, SEPA is responsible for assessing the contribution of NFM to managing flood risk. The assessment often referred to as 'Section 20 Assessment'. It is a high-level nationwide implementation scheme to identify areas within catchments where NFM could potentially reduce flood risk. The outputs identify actions to be taken to manage the risks. Subsequently, NFM's potential is evaluated against and in combination with other measures with the aim of identifying the most sustainable pathways to flood mitigation (Johnstonova *et al.*, 2012).

The nature of NFM application requires collaboration with several stakeholders at different levels. Where it was successfully applied, local flood knowledge contributions from community members, farmers and land owners was utilised. Since decisions on vulnerability are made within a social-cultural context, the successes of management strategies are partly determined by the nature of values that impact the decision-making process. From a scientific perspective, the concept of NFM could provide an ecosystem approach to environmental management where strategies could be designed to deliver additional benefits such as improved water quality, sediment control and other biodiversity

benefits. However, the socio-dynamic and relation impact decisions as well. Other key environmental challenges border on the legal, policy and institutional, socio-economic and technical context.

a. Land Use

The trans-boundary nature of NFM requires collaboration as measures could transcend boundaries. Since this could require significant land areas, food security issues could place additional pressure on productive areas. Furthermore, there are currently no existing financial mechanisms to compensate landholders for neither any losses caused by the implementation of NFM techniques nor is there any direct government funding to encourage the application of these measures (Howgate and Kenyon, 2008). In some cases, NFM objectives could be in conflict with alternative development plans.

b. Community Perceptions and Attitudes to Proposed Measures

Kenyon and Howgate (2009) investigated issues affecting community's willingness to cooperate. The results of the case study showed resistance to cooperate was mostly arising from concerns about alternative flood management techniques, and a sense of 'adopted responsibility' for another's vulnerability and expected beneficial incentives.

c. Policy and Institutional Constraints

Some NFM proposals involve changes to existing land use. These presents constraints on both the acceptability of such interventions, the geographical scale and the time scales over which they might operate. Floodplains are prime productive areas and reserved for food production. In the light of food security concerns and where these areas are required for flood retention, the farmers

will need to be compensated for income forgone and fall in the capital value of the land. Others issues to be addressed include hydro-morphological restorations which require an integrated approach involving multiple landowners and concern involving the timescale in which these interventions need be planned.

d. Legal Constraints

The conservation status of a river and certain modifications requires approval and necessary permits from SEPA under the Controlled Activity Regulations (CAR). Potential legal constraints can be grouped into three broad classifications: (i) the conservation status of the river throughout its whole length (extending out to 5m either side of top bank level); (ii) requirements to obtain the necessary permits from SEPA under CAR and (iii) planning and development policies of the Scottish Borders Council.

e. Scientific and Technical Constraints

Data requirement for NFM applications is often complex. Also, communication of the scientific and technological evidence to lay, persons, is considered a potential barrier to implementation. Since the contributions of NFM in flood mitigation are still "work in progress", little evidence exists to indicate to land owners what precise ecological benefits they can get from NFM. Reliability issues in rainfall patterns and the impacts of climate change is seen as potential barriers in judging the benefits and impact of NFM schemes in flood mitigation.

2.5 Adaptive Flood Management In Sub-Saharan Africa

Climate variability and change are already having considerable impacts on Sub-Saharan, because of direct adverse effects, high agricultural dependencies and

limited capacity to adapt (Collier et al. 2008; Brown, 2015; Cairns et al. 2013). Threats further exacerbated by wider development pressures, which compound the already complex socio-economic and ecological relationships. These are expected to have adverse effects on hydro-energy supply, food security, public health and several other sectors as water is a multi-sectoral resource that links to all facets of life and lives hood (Petermann, 2008). Factors such as deforestation and unplanned development are known to accentuate the hydro-meteorological hazards such as floods and increase the vulnerability of human populations.

The general trend of disasters in the region has been towards an ever-increasing frequency of flood occurrences with some countries which often experience long dry spells, witnessing the worst ever floods. Examples in Namibia and Tanzania recorded extreme events between 2008 and 2012. Drought and floods have also claimed more victims than any other events during the same period (Van Langenhove, 2012). Hence the need for effective strategies is urgent, given the inevitability long lead times for infrastructural and institutional responses. The integration of adaptive "solutions" requires careful considerations across traditional boundaries of practices. Case studies from African practitioners and researcher show many opportunities for improving the management of existing water infrastructures. Part of this is making existing reservoirs more climate adaptive, integrating land management in floodplains to accommodate floods events and effectively utilise natural storage capacity of the flood plains in combination with the upstream reservoir to reduce the risk of flooding (Petermann, 2008). In addressing these

challenges will require sophisticated technical feasibility analysis, hydrologic modelling and experimental reoperations.

2.5.1 Challenges for Adaptive Management in Sub- Saharan Africa

In recognising climate –related disasters, some African government have put in place structure for domestic flood mitigation. However, as discussed in section 2.4, many problems still exist in integrating ecosystem services with landscape planning and management and design (De Groot *et al.*, 2010; Hauck *et al.,* 2013). The primary challenge for development lies at the scale of local natural resource management in promoting adaptive capacity alongside competing for development objectives (Adger *et al*. 2003). Di Baldassarre *et al.* (2010) attribute increased flood risk in Africa to intensive and unplanned human settlement in flood prone areas. They recommend early warning systems and discouragement of human settlements in flood-prone areas as economically sustainable strategies. Meeting these challenges will require policy change across inter-disciplinary and professional boundaries.

2.5.2 Social Issues

Factors such as culture, social and cognitive processes affect society's assessment of risk (Lavell *et al*. 2012). According to Cutter *et al.* (2003), social vulnerabilities are partially products of social inequalities in that those factors that influence the susceptibility of communities to harm also govern their ability to respond. Likewise, interrelationships between social conditions i.e. basic needs, cultural diversity, tradition, institutional restrictions and social networks influence the attention and sense of urgency the public identity with climate risks (Werlen, 2015). Lack of environmental education is also a barrier to

participation in many developing countries (Werlen, 2015; Hellmuth et al., 2007). Also, the acceptability of policies in promoting adaptation often relies on the willingness and cooperation of intended beneficiaries. Patt and Schroter (2008) case study research of resettlement in Mozambique showed this to be the case as farmers and policy makers disagreed about the severity of climate risks and consequence of proposed adaptive measures. In a comparative analysis of eight water management regimes in Europe, Africa and Asia, Huntjens *et al*. (2011) reveal the importance of socio- cognitive dimensions as emerging properties of complex adaptive governance systems inefficient management.

2.5.3 Technical Constraints.

Strategies for SFM require an understanding of consequences and possibilities at different decision levels (political, regional and local) as economic and technological factors define different decision scenarios. The practical challenge for most developing countries includes accessibility to quality climate and hydrological information needed to design water management infrastructure (Muller, 2007). Changing Climate scenarios and spatial variability makes accurate forecasting difficult and poses problems for flood warnings. Examining long- term change in Africa is complicated because of the gaps and irregularities in climate data (Douglas *et al*. 2008).

2.5.4 Policy and Institutional Constraints.

Institutions play vital roles in facilitating the transformation from coping capacity towards adaptive capacity as disasters pose a challenge to society and government. Current pathways in CC adaptation aim at restructuring decision-

making processes for transformational adaptation. Institutional designs for governance of adaptation in the water sector will require additionally adjusted design proposals that facilitate learning processes (Huntjens *et al.*, 2012). Berman *et al.* (2012) show how coping and adaptive capacity is hypothesised in resilience and vulnerability approaches to CC adaptation. Their research identified four key challenges in understanding this process to be: (i) the unknown nature of adaptive capacity (ii) the temporal trade- offs between coping and adaptive capacity (iii) the limited focus on local communities, and (iv) the lack of empirical evidence.

Africa's future economic development has a high level of dependence on water availability (Desanker and Magadza, 2001). Policies aimed at promoting adaptation require the understanding of farmer's perception of climate change and measures to tackle it (Bryan et al., 2009). Barriers to effective management of floods in most African countries are attributed to weak governance and institutional failures (Kithiia, 2011). As discussed in section 2.3, these challenges recommend relevant policy options, stretching from developing institutional capacities to improving the knowledge base.

2.6 Initiatives to Encourage "Adaptive" Approaches for Flood Mitigation in Sub-Saharan Africa

2.6.1 Community –Based Disaster Preparedness: Local Capacity Building

Community-Based Disaster Preparedness (CBDP) approaches are essential elements of vulnerability and disaster management strategies. CBDP approaches associated with a policy focus that values indigenous knowledge

and capacities of local communities to formulate social coping and adaptation strategies; while placing them within the wider spectrum of development planning and debate. The focus is on poor communities due to their greater vulnerability to environmental problems. CBDP methods enable community–government partnerships in encouraging participation. CBDP strategies have been used in criticism of interventionist approaches in disaster management. CBDP places emphasis on community – based approaches and other pre-emptive methods that focus on the root causes of vulnerability rather than isolated disaster events (Blaikie *et al.*, 1994). Precise prominence is put on local capacity – building (Christie and Hanlon, 2001; Benson et al., 2001). In explaining why disaster risk had different nuances and policy responses, Paul *et al.*, (2016) compare objectivism and social constructivism. He concludes social constructivist assumptions are required to analyse disaster risk as it offers a discursive methodology to disaster risk policy science and also illuminates competing local perspectives.

2.6.2 Inter-Agency Collaboration

Limbu et al. (2015) present a bottom-up humanitarian innovation from Kenya known as Kenya Inter-Agency Rapid Assessment Mechanism (KIRA), a mechanism capable of conducting a multi-agency, multi- sectoral assessment of humanitarian needs. 700 humanitarian partners were trained as part of government –led the rapid response. In another African study, Wuni, (2007) explores inter-agency coordination efforts in Northern Ghana.

2.6.3 Multi- Functional Approach

Several authors (Schindler et al. 2014; Zasada, 2011; Mander et al. 2007; Ashley et al. 2007) have defined Multi- Functional landscapes. The basic notion is that a given area can fulfil different functions i.e. ecological, economic, cultural, aesthetical functions (Brandt, Tress and Tress, 2000). The eco-system approach emerged as a central principle in the implementation of the Convention on Biological Diversity in 1995 (Georgiou and Turner, 2012). A study in Cameroon shows multi-functional agriculture delivered social, economic and environmental sustainability to local farmers (Asaah *et al.* 2011).

2.6.4 Environmental Awareness And Learning

Learning is a prominent component in the management for resilience (Walker *et al*. 2002). Within communities, researchers and policymakers need to design indigenous metrics for success. Fabricius *et al*. (2007) present three categories of communities based on adaptive and governance capacity: (i) powerless spectators; (ii) copying actors and (iii) adaptive managers (see section 2.6.3). According to Tschakert and Ann Dietrich, (2010), distinct dimensions of the day to day risk and structural poverty make the design of resilient live hoods pathways of adaptive capacities difficult for most developing countries. However, the research proposes a methodological approach that emphasises a multifaceted iterative way of analysing and learning, through local scale exploratory scenarios linked to larger scale drivers.

2.7 Summary

Sustainable flood management as presented require progressive management approaches towards whole catchment and adaptive planning. Current

development policy embraces holistic catchment planning and increased stakeholder participation for management. A background synopsis of management approaches and unique challenges in developing and developed countries is presented. This is done to give a clearer understanding of challenges for flood management in the case study. Climate change impacts and increased flood for the future presents a pragmatic base for adaptive responses. NFM is presented here as an adaptive management response to flood risk. In line with this, NFM contributions and its principles in flood mitigation are acknowledged. However, the nature of NFM application is bespoke and dependent on community collaboration alongside many other factors i.e. social network, land availability among other factors.

This chapter has presented evidence based UK example of NFM and its application in various sectors showing the scientific contribution of NFM in flood mitigation. Adaptive flood management response in sub-Saharan is presented as a base for the NFM consideration in Nigeria. Within this, potential challenges are identified to lie within the social, technical and institutional spheres. Initiative for encouraging adaptive approaches is also presented to local capacity building through community-based disaster preparedness; inter-agencies collaboration; the use of multi-functional approach and environmental awareness and learning.

Within this debate, the contributions from a social constructivist perspective can be enlightening and bridge some existing gaps in current NFM approach. Community participation in this field is an established area which can significantly enhance existing strategies but which needs to be properly

conceptualised to underline the significance of partnerships and knowledge and vital contributor factors in this debate. The next chapter (3) presents flood management in Nigeria.

CHAPTER 3

3. FLOOD MANAGEMENT IN TARABA, NIGERIA

3.1 Introduction

A review of flood management procedures in Nigeria is presented in line with the second objective of the research (see section 1.5). This segment addresses current practices in Taraba state to identify key issues that would make a difference in flood management. The physical and social description of the case study area (Taraba state) is laid out to give a background synopsis; current management situation is argued, and the potential development of NFM as a viable option for flood mitigation is considered.

3.2 Understanding Culture And Practices Of Flood Management In Taraba, Nigeria

Perennial flooding in Taraba has had far-reaching environmental, health and socio-economic impacts (Oruonye, 2012; Isa, 2015). The magnitude of these impacts has attracted the attention of local and national authorities especially on the need for adaptation and mitigation of the local population. The 2012 event has been the worst in recent times, and some communities are still yet to fully recover (Oruonye, 2015). Two types of approaches to management is applied in Taraba state, engineering and traditional approaches. The local communities depend on the state government agencies or development partners for these approaches in response to flood mitigation but mostly apply traditional approaches locally.

The traditional approach builds on indigenous knowledge, previous flood experiences and local technologies developed over time (Green and Raygorodetsky, 2010). It identifies past and current coping strategies developed by communities to adapt to and mitigate flood impacts. Although indigenous knowledge is considered significant in designing and implementing sustainable development projects, very few studies have incorporated the approach in formal adaptation strategies (Nyong *et al*., 2007). Findings from the field research confirm this to be the case in Taraba state.

In Nigeria, traditional knowledge strongly linked to local culture and past experiences (Wahab and Ojolowo, 2012). Communities have over an extended period acquired knowledge about their experiences with nature, through daily interactions and perceptions of their immediate environment. Most residences have intimate knowledge of their surroundings, including physical, sociological and spiritual contents. There are also different views and concepts of indigenous knowledge for flood management, practices that evolved through trial and error, have been proven flexible to cope with change (Melchias, 2001). In relation adaptive strategies, responses must take into account indigenous approaches that communities are familiar with and on which they could readily apply themselves (Fabiyi and Oloukoi, 2013).

FAO (2008) presents assessments of community coping strategies to climate variability and extreme weather events. However, natural resource management policies within forest management, river basin and fisheries in Nigeria are still based on a top-down approach where community participation is minimal. This local knowledge and practices have been excluded despite their

valuable contributions for mitigation and adaptation research efforts towards sustainable ecological development (Fabiyi and Olouki, 2013).

Social research has proven useful in natural hazards mitigation by understanding how cultural backgrounds influence flood responses. Taraba is a highly heterogeneous and multi-ethnic state. Ethnic groups speak different languages and with each major group forming a mosaic in at least one local government area. Other smaller groups live in harmony with the majority. At the local levels, the role of community leaders is significant within micro-environments. Their ability to coordinate, enforce rules, monitor behaviour and verify actions related to any intervention in the community is vital for any comprehensive economic and social development programme in Taraba state. The argument for community –based development is that communities have a better knowledge of prevailing local conditions, have similar prevailing problems and have an established form of local governance; as a base to mobilise local participation.

3.3 Description of Taraba State

3.3.1 Physical Environment

Taraba state, (see Figure 4.1) is located in the Benue Valley (North-eastern fringe of Nigeria). It lies approximately between latitude 6°30" and 9° 36" and longitude 9°10"50" East in the Upper Benue catchment. The state covers an area of 60,291.82km^2. Bounded by Bauchi and Gombe states in the north-east; Adamawa state on the east and by Plateau state in the north-west. The state is further bounded to the west by Nasarawa and Benue states while its shares an

international boundary with the Republic of Cameroun to the south and south-east.

a. Population Structure and Distribution

According to the 2006 census figures released by the Nigerian National Population Commission (NPC), Taraba state has a population of Two million, three hundred thousand seven hundred and thirty-six (2,300,736) (NPC, 2006), with a projected growth rate of 3% (Oruonye and Abbas, 2010). Taraba is predominately rural, based on the census figures only about 11.6 per of the states' population live in four towns with populations exceeding 20,000. It also has a total land mass of about 6 million hectares out of which, 4 million are arable, and about 1.3 million hectares are put under crop cultivation annually. Crops that thrive well and which can be cultivated in commercial quality in the state include cereals (Maize, Millet, Sorghum, and Rice); roots and tubers (Yam, Cassava and Sweet Potatoes); Beverages (Tea, Coffee, Cocoa and Ginger); Legumes (Sesame, Groundnut); tree crops (Mango, Orange, Oil Palm, Guava, Cashew) (Umar *et al*, 2014). The state also boasts of a significant number of livestock (18 million animals) and has the highest concentration of cattle in Nigeria (Umar *et al.*, 2014).

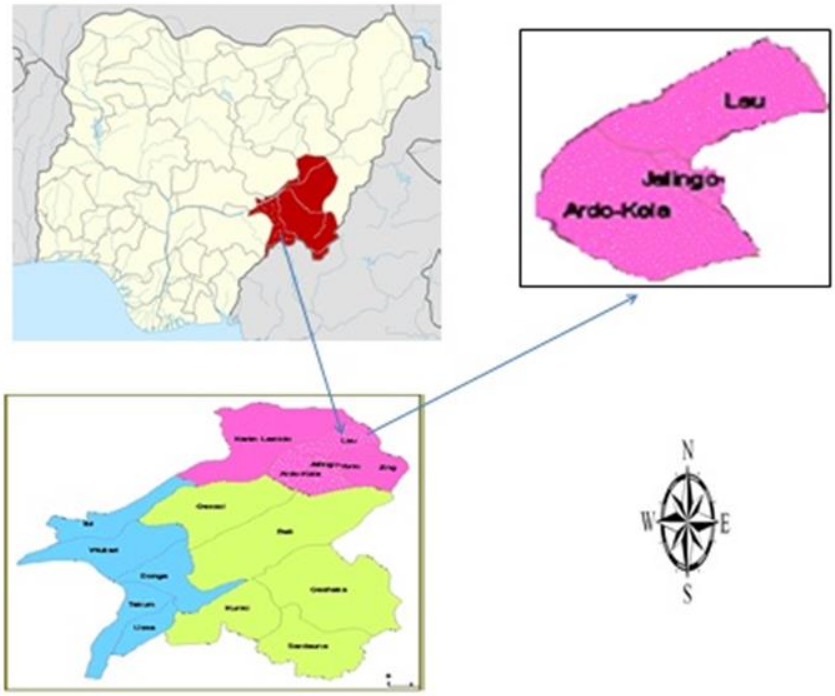

Figure: 3.1 Map of Nigeria showing Taraba State and case study location

b. Rainfall / Climate

Precipitations represent the main factor generating floods in Taraba state. Other source includes the periodic release of flood water from the Lagdo dam in neighbouring country Cameroon. The dry/rainy season's common to tropical regions is the dominant climatic feature. The climate varies from arid with low relative humidity as low as 10% in February to very humid with relative humidity as high as 98% in August. The rainy season starts in April and ends in October with the greater part of precipitation falling in June, July, August and September. The average annual rainfall is between 1000mm-1200mm with duration of about 100 days (UBDA, 2012). Soil and Hydrology are conducive for

the cultivation of most staple food crops, grazing land for animals and fresh water for fishing as well as forestry.

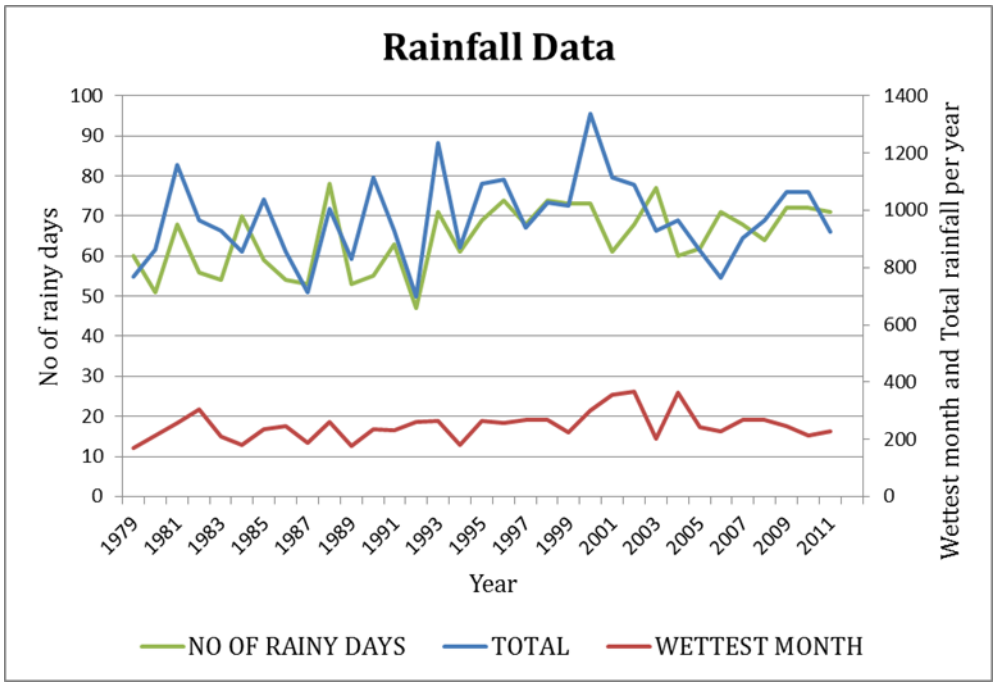

Figure: 3.2 Rainfall data for Taraba State

Source: UBDA, (2012)

c. Morphology and Geology

Geology consists of three major rock types namely the granitic rocks of the Precambrian basement complex occurring as outcrops or covered by the varying thickness of recent deposits; sedimentary rocks; Basement complex rocks, consisting of Gneiss-migmatite, Quartzite and other Granitoid rocks. The Quaternary to Recent deposits from the youngest litho-stratigraphical units in the State associated with the river valleys and floodplains (Nur and Ayuni, 2004; Kogbe, 1976).

d. Vegetation

The vegetation comprises of three types namely guinea savannah, which is marked by forest and tall grass found in the southern part of the state. The Sudan type characterised by short grasses interspersed with short trees and the semi-temperate zone marked by lush pasture and short trees (Kogbe, 1976).

Figure: 3.3 River Lamurde (main river running through Jalingo LGA) showing encroaching development and siltation

Source: Researcher's field work pictures.

3.4 Current Flood Management Situation In Taraba: A Review

Flood hazards in Taraba state continue to be a yearly challenge. The increasing frequency and losses associated with flooding have made it imperative to find ways of mitigating flood impacts and its associated risks. In the Daily Trust, Isa (2015), reports of the 2015 floods displacing over 15000 families in six local government areas of the state. Similar major floods in 2005, 2009, 2011, and 2012 accrued massive losses (Oruonye, 2013; Ishaku *et al.*, 2011). These

flooding events reveal the several challenges regarding the state's disaster preparedness, and the need to strengthen Disaster Risk Reduction (DRR) mechanisms. The key risks hover on the agricultural systems, riverine neighbouring communities, health sector, transportation and urban habitats among others.

Government responses to flood hazards in Taraba have always been a piecemeal fashion. Oruonye (2013) reports on disaster management response by government agencies, voluntary organisation and civil societies to be indigent in 2005, 2011 flood disasters. This he accredited to poor logistics and inadequately trained personnel within the disaster management teams. Urban development and expansion in Taraba state provide an illustration of some of the most obvious effects of land use change on water management. Uncontrolled human development without adequate consideration for environmental planning codes has led to the continuous loss of land cover and natural resource in Taraba state. Consequently, human and ecological challenges of varying magnitudes are rapidly emerging. Oruonye (2015) identifies the major causes of flooding in Taraba state to include uncontrolled development and encroachment into flood plains, lack of adequate storm water drainage systems, lack of maintenance of existing drainage systems and weak institutional capacity of public administration and environmental management in Nigeria.

Of particular concern is the fact the most impoverished segment of the population who are most likely to settle in flood hazard-prone areas are the least able to adopt measures for adaptation in the event of the flood disaster.

Addressing these problems will require an effective environmental management agenda; the integration of spatial planning and flood-risk management and a consideration of sustainable draining systems to tackle flood hazards (Adedeji *et al.*, 2012). It becomes ever more pertinent to examine what mechanisms can foster better stakeholder engagement for management. This research is posted on the principles of sustainable flood administration and adaptive community planning for resilience.

3.4.1 Intuitional Framework for Flood Risk Management in Nigeria

Nigeria has no principal Legislation whether at the national or state levels dealing primarily with flood disaster. Flood management in Nigeria falls within the National Disaster Management Framework (NDMF), handled thru multiple agencies, under the three tiers of government (federal, state and local governments). Disaster management in Nigeria is defined as the "coordination and integration of all activities necessary to build, sustain and improve the capacity to prepare for, protect against, respond to and recover from threatening or real natural or human –induced disasters (NDMF, 2010 p:1). In 2010, NDMF was developed to offer a holistic approach to managing disasters, with participation from a wide array of players, including the Federal, State, and Local Governments, as well as Civil Society Organizations (CSOs), and private sector organisations (NDMF, 2010). The NDMF provides a regulatory mechanism that ensures efficient and effective disaster management for government officials, community leaders, private organisations, CSOs, and practitioners (NDMF, 2010). Also, the NDMF defines the roles and responsibilities of disaster management stakeholders (NDMF, 2010).

Formal opportunities for public participation are prescribed in the National Disaster Management Framework. Community structures such as the neighbourhood associations, school, and faith-based organisations are expected to participate in disaster management activities through LEMA (local government levels) with the support of SEMA (state level) and NEMA (National level). The roles prescribed for the communities include commitment and preparedness of community members to disaster management; sensitization and capacity building of communities that constitute disaster fronts; mobilising community resources to build capacity and resilience to prepare for, respond to and mitigate the impact of disasters (NEMA, 2010). Though the framework makes provision for community participation, it does not explicitly specify the mechanism to ensure a voice for the entire element of "participation" mentioned. The framework provides insight into opportunities however it represents simplifications of a more complex reality based on the dimensions of power allocation within the structures and the capacity for community inclusion. In practical terms, communities are usually incorporated in last four steps of Arnstein ladder of participation. (See figure:2.6).

The Federal Government of Nigeria enacted into law the National Emergency Management Agency (2004) Act. The Act deals with natural disaster without any special provision to tackle the menace of flooding. At the federal level, the Nigerian Emergency Management Agency (NEMA) is the lead agency for managing disasters (see fig: 4.6) through its six zonal offices spread across the country (Fagbemi, 2011); State Emergency Management Agencies (SEMAs) at the state levels and Local Emergency Management Agencies (LEMAs) for the local government levels (NDMF, 2010; Fagbemi, 2011). All three emergency

management agencies are charged with the responsibility of developing capabilities to prepare, prevent, respond to, and recover from disasters (NDMF 2010). Other stakeholders in Nigeria's emergency management system include, but are not limited to, the military, police, para-military, and CSOs (NDMF 2010). The River Basin Development Authorities Act (1986) is another legislation that addresses flooding problems in Nigeria. Its jurisdiction covers eight hydrological areas of the country (Landan, 2012). Also responsible for the administration dams, control of flood, erosion and the provision of infrastructure for agricultural programs (Omole, 2013). The authority is to coordinate the activities of the River Basin Development Authorities in Nigeria. The authority has numerous, but one relevant to flooding is stated below:

*"To undertake the comprehensive development of both surface and underground water resources for multipurpose use with particular emphasis on the provision of irrigation infrastructures and the controls of floods and erosion Moreover, for watershed management". (*RBDA, 1986).

The Act is not a law designed primarily to address the problem of the flood disaster in Nigeria. However, the Act tersely refers to the issue of the flood in sections 26.

Section 26 of the Act provides:

(i) The agency may make regulation, guidelines and standards for the protection and enhancement of the quality of land resources, natural watershed, coastal zones, dam and reservoirs including prevention of flood and erosion, to serve the purpose of the Act.

(ii) In drawing proposal for such regulations, guidelines or standards, the

the agency shall take into consideration the Zonings Acts, Municipal Development guidelines and Building codes to prevent siting of essential facilities on a flood plain."

3.4.2 Institutional Response to Flood Management

The National Emergency Management Agency (NEMA)

i. The National Emergency Management Agency (NEMA) established through Decree 12 of 1999. By this decree, the agency is the authority responsible for disaster management (Adeoye *et al.*, 2009). Part of provisions with relevance to this research is: ……Educate and inform the public of disaster prevention and control measures.

Since the promulgation of the decree, NEMA has developed a national contingency plan for disaster response (Adeoye et al., 2009).

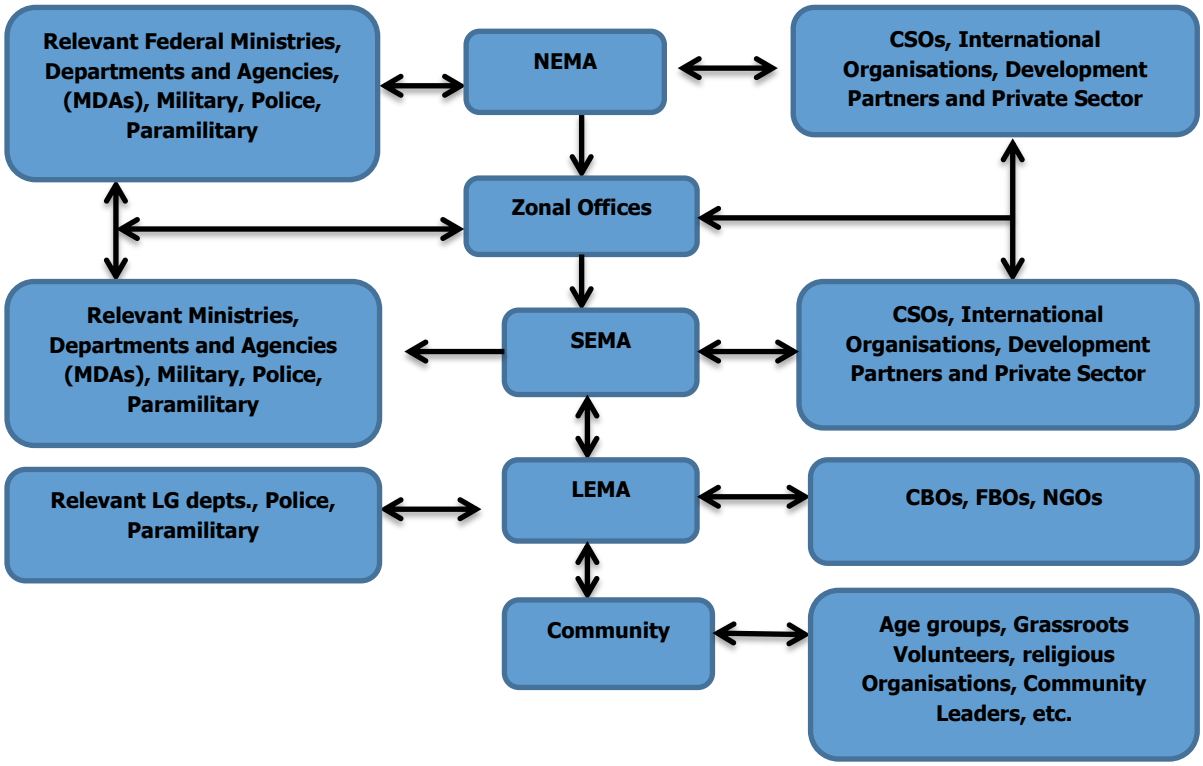

Figure: 3.4 Horizontal and vertical coordination of Disaster Management in Nigeria

Source: NEMA (2012).

3.5 Flood Management Strategy And Potential Development Of Nfm For Flood Risk Management

Taraba like many states in Nigeria grapples with environmental issues. The current level of preparedness and capacity building to tackle flooding hazards leaves much to be desired. Several studies have called for a reexamination of current strategies and consideration of bottom –up adaptation strategies for resilience planning. These to include a critical examination of the role of spatial planning, sustainable drainage systems and land use management in building capacities to tackle flood hazards (Odemerho,2015; Fabiyi & Oloukoi, 2013; Adedeji *et al.*,2012; Egbinola *et a*l., 2015; Adebayo, 2014). Still, yet, Taraba state lacks requisite technical and intuitional capacity for flood risk reduction.

The current flood management structures have failed to give the desired protection for the vulnerable communities within the state.

On adaptation, NASPA-CCN (BNRCC, 2011) articulates key recommendations and action points necessary to minimise risk; improve local and national adaptive capacity and resilience; leverage new opportunities all with the view to reducing Nigeria's vulnerability to adverse impacts of climate change. Al-Amin (2013) gives five strategic recommendations of integrating DRR initiatives in Nigeria's environmental governance, part of which was exploring environmentally sustainable mitigation options and the concept of 'greening disaster –response' and 'sustainable –recovery' within the framework of sustainable development. Others include the establishment of interdisciplinary centres on DRR within the apex organizations of policy, research and natural resource matters; the introduction of regional Environmental Impact Assessment (EIA) as a pre-requisite to long-term planning; the introduction of DRR and post –disaster relief and recovery as compulsory modules within higher education and the establishment of inter-sectoral multi-disciplinary teams at strategic level to develop relevant guidelines, standards and manuals on environmental approach to DRR (Al-Amin, 2013).

3.6 Summary

This chapter has presented the cultural background and flood management practices in Nigeria. It has also presented physical, social characteristics of the study area and current management situation. The key stakeholders and institutional arrangement within the three tiers of government are presented to give a compact representation of the Nigeria scenario. Seasonal rains are

highlighted as the main cause of perennial flooding. Management structures and local communities struggle to cope with increasing trends. Hence, a flood management strategy and potential development of NFM in Taraba is considered.

Adapting to the challenges of rapid growth and societal change in Taraba will require a mechanism for efficient transitioning to a system rooted in resilience. Adaptation to climate change is dependent on current adaptive capacity and the development models being pursued by Nigeria, against this background the challenge for spatial planning is multifaceted. The review shows no principal legislation dealing primarily with flood prevention in Nigeria. The National Emergency Management Agency (NEMA) deals with natural disaster without any special provision to tackle the menace of flooding. The review present stakeholder participation in management as mainly consisting of government agencies with minimal inputs from communities. In addressing this gap, the next chapter presents the theoretical and conceptual framework of the study.

CHAPTER 4

4. THEORETICAL AND CONCEPTUAL FRAMEWORK

4.1 Introduction

The main goal of this chapter is to present key conceptual and theoretical concepts underpinning this study. The social constructivist perspective is presented as significant in analysing risk, illuminating competing for local perspectives within a discourse approach to disaster risk policy science. Focus centres on its relevance in answering questions on vulnerability, resilience, indigenous knowledge/ participation and risk perception as complex and interconnected factors within the adaptation debate. The importance of a social epistemology in linking with scientific claims to knowledge on flood management is presented. This chapter is outlined in the following sections. Section 4.2 looks at adaptive management as a strategy for natural resource management. Section 4.3 outlines core constructivist philosophy underpinning this research, vulnerability and resilience within the adaptation debate. Section 4.4 provides a review of literature about participation in environmental management.

4.2 Adaptive Management And Climate Change Uncertainty

Adaptive Management (AM) emerged in mid-1970 as a way of managing the natural resource in the face of uncertainty (Holling, 1978). Concerning flood management, uncertainty due to climate change impacts and fluctuating socio-economic conditions offer new challenges that cannot be addressed by the traditional command and control approaches (Pahl-Wostl et al., 2008).

Management approaches show that it is no longer tenable to separate the "social" from the "technical" aspects of flood management. Decisions on adaptation are made by individual, groups within society, organisation and governments on behalf of society. It is clear that individual and society have adapted to climate change over the course of human history and will continue to do so as a part of the wider environmental landscapes of human habitation. Future strategies would need to consider social and individual perceptions of danger in developing sustainable responses. Dessai *et al*., (2004) notes that most scientific and policy discourse proceeds with subjective definitions of CC impacts based on a variety of assumptions and assessment undertaken by "experts". They further present two contrasting perspectives of risk what they termed as 'external' (based on scientific risk assessment) and 'internal' (based impacts experienced) and recommend an appreciation of both in policy responses. Birkholz *et al*. (2014) argue for a re-examination of flood risk perception research in a manner underpinned by more constructivists thinking around FRM and development in the wider risk perception research.

The understandings of what constitutes extreme CC impacts are of importance for a future concerted response as impacts could substantially increase environmental and social burdens on future generations (Leary, 2012; Schneider, 2002). Hence adaptation has been widely used in scientific, policy and management spheres in both understanding and application.

In the conceptualising adaptation, the main theory of constructivism applies. The theory suggests that humans construct knowledge and meaning from experiences. According to Borisov (2014), constructivism considers reality as an

open, dynamic system, stemming from a cultural process in which education plays a cardinal role the development of communities towards survival and adaptation. Thus, the new direction of sustainable development seeks to advance multilevel governance through cognisant efforts at constructing policy communities and within these settings, promoting knowledge construction, interchange, and collaborative learning.

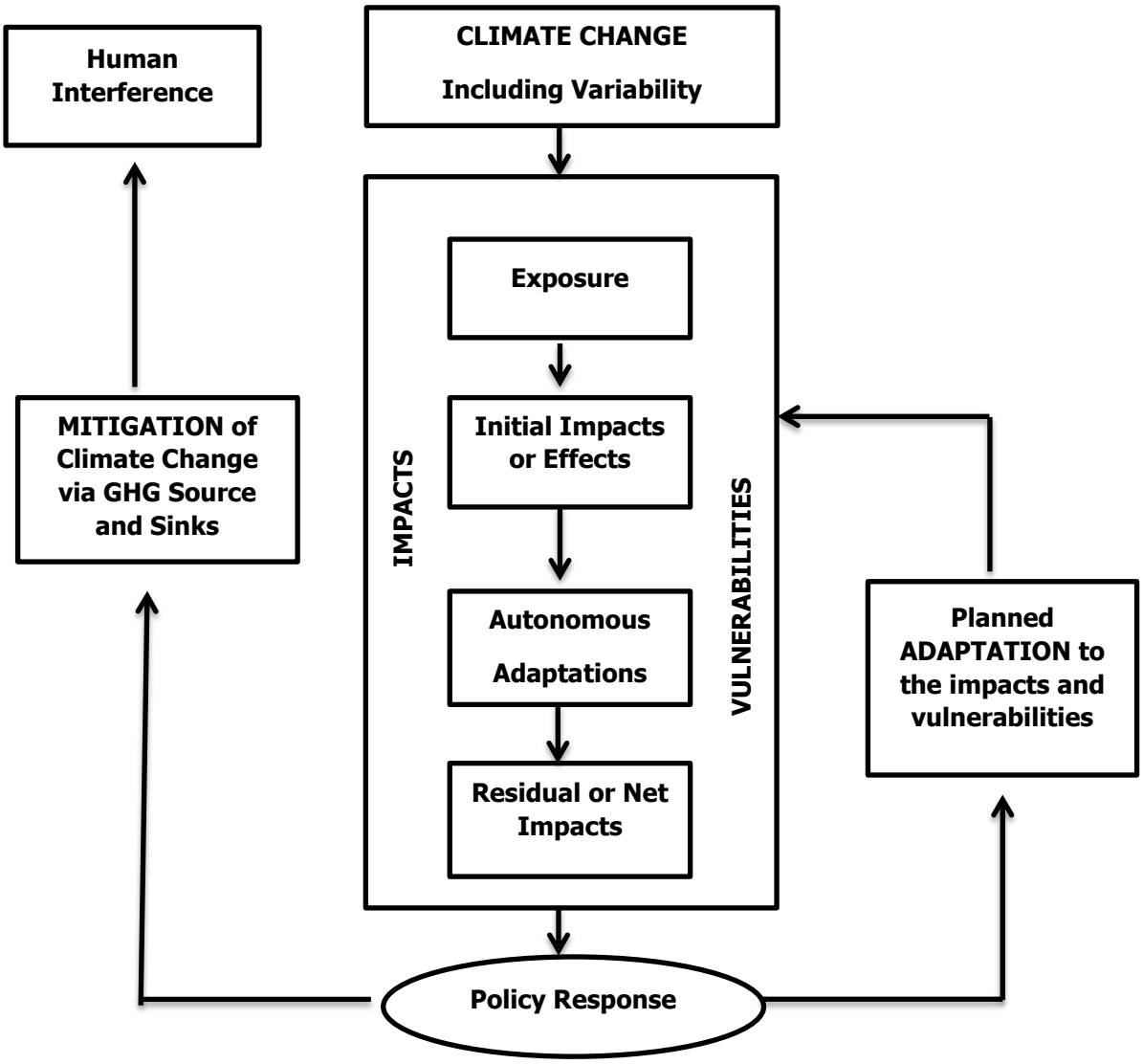

Figure: 4.1 The place of adaptation in response to climate change

Source: IPCC TAR, 2001 after Smit *et al*., 1999

Several studies have examined different aspects of climate change impacts and adaptation needs in African (Ziervogel, G. 2014; Niang et al. 2014; Mullar et al., 2011; Conway and Schipper, 2011). Still, there is limited research into capacities for adaptation governance. Madzwamuse (2011) argues for adaptation governance priorities on local context, in consideration of specific country realities and regions affected by climate change. Central to this approach is an assessment of impacts and vulnerabilities to CC such as climate change adaption policies; national strategies'; the current state of knowledge on vulnerability and level of public awareness on CC. According to Osterblom and Folke (2013), the understanding of social-ecological processes has a direct bearing on tangible environmental outcomes. Therefore understanding community resilience is essential for improving research into adaptation pathways (Ross and Berkes, 2014; Wisson, 2012; Tschakert and Shaffer, 2014; Joseph, 2014). Norris *et al*. (2008) present a theory of community resilience that encompasses contemporary understandings of stress, adaptation, wellness and resource dynamics. In their view, resilience develops from adaptive capacities i.e. economic development, social capital, information/ communication and community competence; a combination of which provides strategies for disaster readiness. Other studies such as Aldrich and Meyer (2014) highlight the role of social capital and networks in disaster survival and recovery.

For an African perspective, a study by Joseph (2014) reports on the SHARE project, an EU project relating to resilience building in the Horn of Africa. His findings suggest resilience is understood as part of an approach to governance.

He further states that by employing the concept of governmentality, the project was part of a wider strategy that sort to govern from a distance.

In Nigeria, findings from Heinrich Böll Stiftung (HBS) show the policy framework for climate change adaptation governance is inadequate with state actors dominating in most of the strategies. The report also shows the low participation of civil society organisations and local communities in the formulation of national climate change adaptation policies and strategies (Madzwamuse, 2011). Figure 5 demonstrate the place of adaptation in responses to climate change impacts.

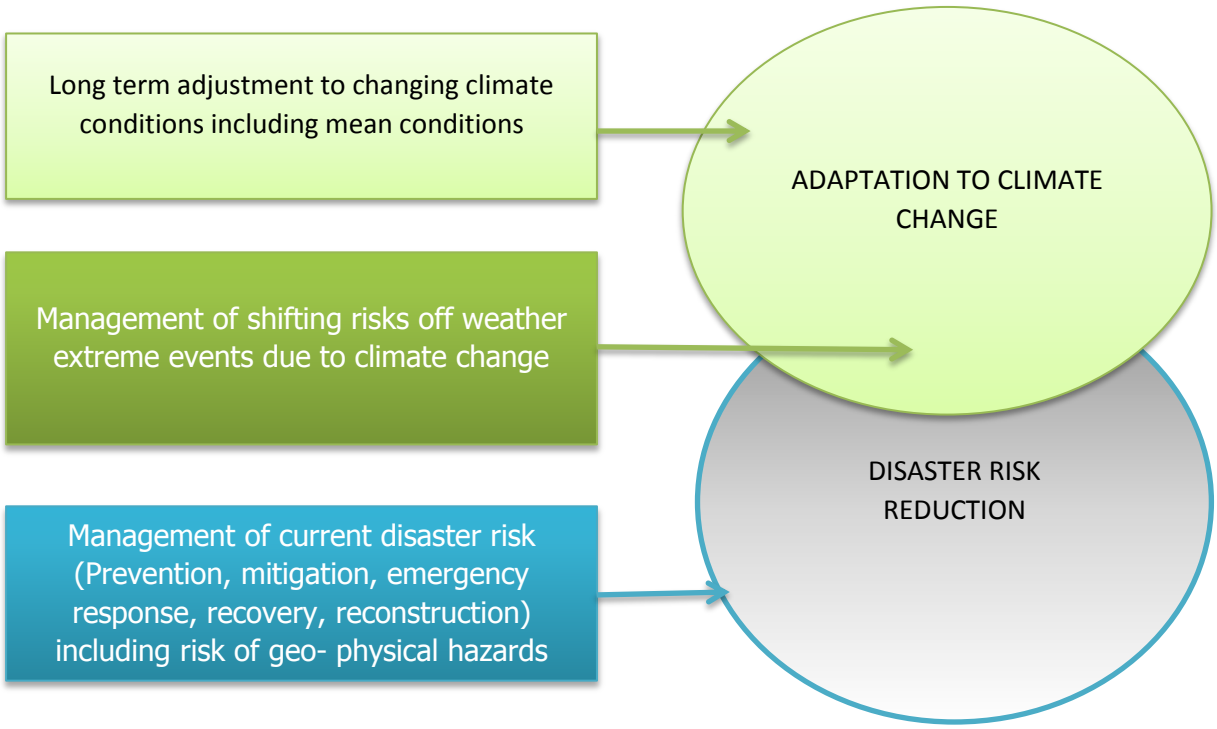

Figure: 4.5 Conceptual approach to the overlapping agendas of climate change adaptation and disaster risk reduction (DRR).

Source: World Bank (2010).

Disaster resilience is the foundation of effective emergency management across all phases of disaster risk management from preparedness through to response and recovery. Murphy *et al*. (2013) findings from cross-case analysis of different regions within Canada show small rural communities harnessing inherent strengths to enhance disaster resilience. The value of undertaking resilience planning perceived as important as outcomes encouraged resilience thinking and proactive planning. This conceptualization has significant implications for community perspective on disaster resilience management as disaster risk (identifying, mitigating, preparing for and responding to the risk) is an essential component in building resilience in practice. Understanding communities as complex adaptive systems could help in the development of bespoke management plans that empowers communities to use their local knowledge and decision-making processes to take action. Nevertheless, the desired sustainable strategies consider vulnerability, adaptation possibilities and effect analysis of these adaptive strategies under different possible future scenarios (Haasnoot *et al*. 2011). Key types of adaptation benefits are present in Table 4.1.

Table 4.1 Key types of adaptation benefits, with examples

Local private benefits	Local public benefits	Direct global public benefits	Indirect global public benefits
Sustained agricultural production Value of saved crops for individual farmer Higher household income Less vulnerability to extreme weather events	Flood –proofed infrastructure Afforestation preventing erosion and loss of valuable farmlands Enhanced environmental services	Control of climate – sensitive infectious diseases Protection of climate sensitive biodiversity Improved research on flood-resistant crops	Avoided international migration Reduced pressure on conflicts Lower prices instability on climate –sensitive agriculture products

Source: IPCC (2001)

4.3 Social Constructivist Perspectives On Flood Management

"Language and culture are the frameworks through which humans experience, communicate and understand reality" (Lev Vygotsky, 1968)

Background - Social constructivism assumptions emphasise the collaborative nature of learning. Vygotsky (1978) argues that all cognitive functions originate in, and must be explained as products of social interactions and that learning is the process by which learners are integrated into a knowledge community.

View of Knowledge - In its view of knowledge, as see it as actively constructed by learners in response to interactions with the environment. Vygotsky emphasises the role of language and culture in cognitive development. As language and culture play essential roles in human intellectual development and how humans perceive the world (Vygotsky, 1968).

View of Learning – learners responds not to external stimuli but their interpretation of those stimuli. Learning is more than the assimilation of new knowledge by learners; it was a process by which the learner is integrated into a knowledge community. Learning is a collaborative process.

View of Motivation – motivation as both extrinsic and intrinsic because learning is a social phenomenon.

4.3.1 Climate Change as a Social Construction

Current researchers on climate change highlight the importance of vulnerability knowledge, disaster risk reduction and value of strengthening governance processes. Climate change impacts are witnessed on spatial and temporal scales by systematic knowledge provided by natural sciences; a shared consensus events are part of a changing global climatic system and that its effects are disastrous (Van der Linden, 2015; Reser and Swim, 2011; Hulme and Mahoney, 2010). Paul Harris in his contributions to global environmental politics, states that "the reason climate change has found its way onto international agenda is first that its causes and consequences have become so evident and prudentially significant" (Harris, 2011: 114). In a different view, Rice (2013) recognises the fluid nature of environmental concerns as it pertains to individual and societal consciousness. As environmental problems do not necessarily become imprinted on personal and society consciousness due to worsening physical condition but as a direct response to successful claim making and contestation by a cast of social actors (Rice, 2013, p:39). It implies the 'construction' of environmental problems has a direct bearing the publicity and attention it receives. However, Christmann *et al.* (2014) argue climate

change related perceptions of reality differ between different societies at different places and times. Thus societies construct their specific reality of climate change, based on social attributions of meaning to physical – material phenomena and also to specific systems of relevance (Krüger *et al.* 2015). Hence, the theoretical considerations of the fact that besides physical –material aspects, immaterial factors regarding socially shared meanings are relevant in climate change perceptions of vulnerability. It presents interpretation to be rooted in cultural traditions and experiences of hazards in local history.

Approaches to vulnerability and resilience have mainly been considered by "essentialist" assumptions (Christmann *et al.* 2012). Most approaches are still very technocratic in the sense that it focuses on the hazard and not upon the conditions that favour the occurrence of crisis (Cardona, 2004). For example, in developing countries, social economic, cultural and educational aspects are in most cases the cause of the physical vulnerability. The two concepts have been viewed as an inevitable and uncontrolled physical phenomenon. However, vulnerability is borne out of human experience under situations in which it is often difficult to differentiate normal life from disaster i.e. an internal risk factor of the system that is exposed to a hazard and corresponds to its natural predisposition to be affected or to be susceptible to damage (Cardona, 2004). The vulnerability here represents the physical, economic, social proposition of a community to threatening phenomenon of natural or anthropogenic origin. These conditions could accumulate to make live hoods extremely fragile for certain social groups. In planning adaptive responses, development would need to be implicit as a process that involves synergies between communities and the environment, and thus vulnerability in social groups may be understood as

the reduced capacity to "adapt to" a determined set of environmental settings (Cardona, 2004).

In a quest for fuller understanding of vulnerability and possibilities for real mitigation, a number of social scientists have studied social aspects of vulnerability reduction under social inequality, multilevel governance, institutional structures and relations among others (Hemingway and Priestley, 2014; Jabareen, 2013; Bauer and Steurer, 2014; Berman *et al*. 2012). However, there is a paucity of studies regarding society's indigenous ways of perceiving and defining their reality and in a choice of prevention measures. From this understanding, the research considers theoretical underpinnings of social constructivism as a platform which could accommodate constructivist and essentialist perspectives for sustainable management.

Social science contributions to the climate change debate have been significant. The natural scientist's perspective centres on the physical realities of climate change and which preventive measures are embraced for future management (Kates *et al*. 2012; Merila and Hendry, 2014). On the other hand, social science observes ways that societies deal with climate change as stated by the natural science and how they make it a social reality (Christmann *et al*. 2014). In contributing to the system- theoretical approaches, Luhmann (1989) argues societies develop ecological knowledge in social communications and as such are dependent on particular communications logics of society 's functional sub-systems such as politics, economy, science or religion. Discourse –analytical approaches present climate change perception as reliant on the particular social system in the context of which it is negotiated. For example, Doulton and

Brown (2009) present a media construction of climate change and development in UK newspapers between 1997 and 2007. Showing a broad range of opinions on the impact of climate change on development and actions were taken, the discourse identified eight based on entities recognised, assumptions about natural relationships, agents and their motives, rhetorical devices and normative judgements. Weingart *et al.* (2000) showed the different climate change perspectives of Germany's "discursive arenas" in sciences and politics over a period of 1970- 1995. These demonstrate the difference on sector based rationalities, how climate change is presented and how the discourse has evolved over time.

It is acknowledged from social–science research that climate change is perceived differently between social entities, social fields and time scales. However, little considerations given with regards to how individuals and perceptual- immaterial aspects in the theoretical conceptualization of vulnerability and resilience.

4.3.2 Vulnerability and Resilience: Concepts in Adaptation

Vulnerability and resilience present two related yet different approaches to understanding adaptation to climate change. Adger (2007) defines vulnerability as the degree to which geophysical, biological and socio-economic systems are susceptible to and unable to cope with, adverse impacts of climate change. Thus "vulnerability" as a term refers to the vulnerable system itself i.e. flooding of coastal cities and agricultural lands, or the mechanism causing these impacts. Major impacts associated with the main vulnerabilities in social, economic, geophysical systems have been studied extensively in the literature

(Hitz and Smith, 2004; Oppenheimer and Petsonk, 2005; Leemans and Eickhout, 2004). IPCC (2014:5) defines resilience as "the capacity of social, economic and environmental systems to cope with a hazardous event of trend or disturbance, respond or reorganised in ways that maintain their essential function, identity, structure, while also keeping the capacity for adaptation, learning and transformation". Turner (2010) argue the two terms converged around foundational pivots of sustainability and coupled human – environment system, but differ regarding attention given to their application to environmental service and the tradeoffs of services with social outcomes.

Within scientific discourse, the concept of vulnerability and resilience have gained considerable popularity on human dimensions of global environmental change, influenced by human ecology and research on inherent risk (Lei *et al.* 2014; Moss *et al*. 2013; Kelman *et al*. 2015). Other studies show approaches such as socio-ecological systems (SES) (Daron, et al. 2015; Berkes , 2003 ; coupled human- environmental systems concepts (CHES) (Liu, *et al.* 2007; Turner, et al. 2003) ; social resilience (Hall and Lamont, 2013; Brown, 2014); and social vulnerability (Lee, 2014; Holand and Lujala, 2013).

In a bid for a comprehensive definition of vulnerability and resilience which integrates valuable insights from various perspectives, Birkmann *et al.* (2011) advocate for vulnerability to mean "situations and processes that determine the exposure, susceptibility and also reaction capacities of a system or object about dealing with dangers (…). Here, physical, social, economic and environmental factors play a role" (Birkmann et al. 2011, p. 25). This definition includes social variables as significant contributing factors. Social processes generate unequal

expose to risk by making some more prone to disasters than others (Birkman and Wisner, 2006). Bankoff *et al*. (2004) present two levels of vulnerability. One associated with poverty, resource depletion and marginalisation and the other related to the diversity of risks generated by the interplay between local and global processes and its daily management. Critical to this understanding of disaster is an appreciation of the ways in which human systems place people at risk about each other and the environment. In a relationship that is implicit with regards to the individuals, the community and societal vulnerability.

Resilience has a history with diverse articulations, iterative meanings and positive attributes. Within contemporary debates, resilience is the ability to cope with stress or return to some form of normal condition after a period of stress. Interdisciplinary researchers interested in socio-ecological systems (SES) incorporate resilience and define it as "the ability of human communities to withstand external shocks or perturbations to their infrastructures, such as environmental variability or social, economic or political upheaval and to recover from such perturbations" (Adger, 2000, p: 349). In another definition Birkmann et al. (2011, p: 16) describes it as the capacity of a system to "absorb shocks and disruptions and to continue to exist with the least damage possible". The author's definition identifies three dimensions of resilience: resistance of a system, capacity to restore conditions quickly and capacity to learn and adapt. The above definitions present unique problems in using resilience as a universal concept. In consideration of social factors, the definitions still share essentialist perspectives that present vulnerability as factual exposes or susceptibility and resilience as the actual coping ability of systems (Christmann *et al.* 2014). In another argument, Alexander (2013) maintains resilience rationales seek to

combine adaptation (dynamic) with resistance (static) in one framing concept. Also, sustainability research needs the consideration of both continuity and change while also distinguishing between them (Geels, 2011). Furthermore, whereas resilience theory aims to prevent transitions, social theory seeks to stimulate social transformations. Transformations for the sake of persistence of the system– rather than transformation for change appear counterintuitive to social science thinking (Olsson *et al*. 2015).

Several contributions to resilience literature fail to connect conceptions to theoretical approaches (Jabareen, 2013). This research proposes for the inclusion of socially shared perceptions i.e. the social constructions of vulnerabilities and resilience into account. On adaptive flood management, most concepts do not consider the factors and spatial dimensions of vulnerability and resilience i.e. differentiation of spatial dimensions and analysis of linkages, physical spaces (commercial spaces, cultural spaces).

In the last decade, the concept of adaptation and its underpinning principles have slowly permeated policy making processes over a wide range of disciplines. For example, the UK Climate Change Risk Assessment (CCRA) completed in 2012 gives an assessment of potential effects of climate change, while the National Adaptation Programme (NAP) sets what strategies government, businesses and society need to do to adapt better to the changing climate. In Nigeria, the National Adaptation Strategy and Plan of Action on Climate change for Nigeria (NASPA-CCN) was prepared in 2011 to encourage knowledge sharing, discussion and action on climate change adaptation. Furthermore, the Intergovernmental Panel on Climate Change (IPCC)

interdisciplinary research initiatives focuses on integrating current and evolving understandings of CC impacts, conventional and alternative developmental pathways to achieve the goals of sustainable development. These pathways involve the identification of vulnerabilities to CC, the assessment of opportunities for risk reduction and the adoption of actions that are consistent with the goals of sustainable development (IPCC, 2014). These includes a combination of incremental and transformative responses that considers current and anticipated changes in climate extremes; dynamic development context influencing social vulnerability; risk perception and conflict resolution; resilience and the recognition of human capacity to shape the future and human ability to manage risks, decrease vulnerability through mitigation, adaptation and the choice of developmental goals (IPCC, 2012).

4.3.3 Extended Concept for Analysis of Vulnerability and Resilience: the Constructivist Perspective

Against this background, the research adopts ideas of social constructivism and theories of participation in the application of NFM approaches for flood mitigation.The study investigates flood perception and communication between the major institutional stakeholders involved in flood risk management in the different cultural settings of Scotland and Nigeria. It focuses on the interplay of socially constructed nature of vulnerability and resilience perceptions, indigenous flood risk communication and analysing how differences are embedded in culture and exploring the potential of cross-cultural transferability of good practices and its implementation with consideration of cultural diversity.

Social constructivism stemmed from an attempt to seek to understand the nature of reality; linked to the idea that observations are accurate reflections of the world being observed (Murphy *et al.*, 1998). Berger and Luckmann (1991) had a major influence on the development of social constructivism. Their study is concerned with the nature and construction of knowledge: how it emerges and the process of its significance for society. Their view portrays knowledge as creations of the interactions of individuals within society. In observing society as both objective and subjective reality: objective reality created through the interaction of people with the social world, influences routine and eventually forms a general store of knowledge. It implies frequently repeated actions become a pattern which can be reproduced effortlessly thereby encouraging innovation (Andrews, 2012). When this knowledge in entrenched by society, future generations eventually experience this knowledge as objective. On the other hand, the experience of society as subjective reality is achieved through primary and to a lesser extent, secondary socialisation. Burr (2003) suggests identities originate from the social realms and not from individuals. Moreover, as such, socialisation takes place through others who mediate the objective reality of society using the medium of language (Berger & Luckman, 1991).

While all social constructionists reject the idea that we can never know 'reality' exactly as it is (i.e. they accept epistemological relativism and reject epistemological realism). Macnaghten and Urry (1998) notes that the assumption that environmental problems exist in nature waiting to be 'read' by evolving scientific knowledge is giving way to the idea that there are 'multiple natures' as visual criteria are implicated in the definition and trajectories of even the most apparently environmental issues.

The research views vulnerability as the result of a social construction process where potential threats are collectively assessed and negotiated by members of a community towards collaborative/ co-operative learning for enhanced environmental management. Constructing community vulnerability implies a consideration of social, immaterial, material and spatial elements considered essential.

Resilience now is understood as a construction process which underscores remedial and management reactions of treats at a certain point in time to reduce the vulnerability of community by protecting its functions and integrity.

4.4 Making Sense Of Stakeholder Participation

The concept of stakeholder participation progressed through a series of distinct phases : from awareness raising in the 1960s (Tatenhove and Leroy(2003) ; incorporating local perceptions into planning, where participatory approaches had been developed in part, as a response to the top-down, science-led transfer of technology paradigm in the 1970's (Pretty, 1995); the development of techniques that acknowledged local knowledge and encouraged participatory rural appraisal in the 1980s; the adoption of participation as a norm in the sustainability development agenda in the 1990s (e.g. UNCED, 1992); a critique of the limitations and drawbacks of the participation in 2000 (Cooke and Kothari, 2001); and finally to the cross-disciplinary approach to learning alliances. (Sabastiaan *et al*. 2011). SWITCH PROJECT.

Public awareness issues and concerns about the quality of the environment have triggered several forms of public participation. Formal opportunities for public participation in EIA are explicit in legislation (EC, 1999). While rights of

involvement in many countries are limited to opportunities for viewing and commenting on finalised reports, in principle, public consultation and participation could occur at every stage in the EIA process. A typology based on different degrees of participation describes a range of increasing stakeholder involvement from inactive dissemination of information to active engagement (Davidson, 1998). However, Richards et al., 2004 argue that the different levels of engagement be likely to be appropriate in different contexts, depending on the objectives of the work to be done and the capacity for the stakeholders to influence outcomes.

Rowe and Frewer, (2000) emphasised on the nature of participation, identifying the different types of public engagement according to the direction of communication flows between stakeholders. In this approach, "participation" is conceptualised as two-way communication between participants and exercise organisers where information is traded in some dialogue or negotiation.

Other typologies fundamentally distinguish normative and pragmatic participation. Normative participation centres on the process, suggesting that people have a democratic right to participate in environmental decision-making. Other the order hand, logical arguments emphasis on participation as a means to an end, which can deliver higher quality decisions (Warner, 1997) (Beierle, 2002) (Tippett et al., 2007). The disparity between these two types of participation has been presented in different ways. For example, the "communication action theory" by Habermass (1987), suggests participation should be "unbiased", representing the full range of relevant stakeholders and equalising powers between them. This distinction is regarded as the need for

"public acceptance" versus "decision quality", or "political" versus "technical" participation (Thomas, 1993; Beierle, 2002).

Other attempts in developing typologies centres on the objectives for which participation is required. These include Okali *et al* .,(1994) distinguished between "research-driven" versus "development-driven" participation; Michener (1998) compared "planner- centred" participation that centres on outcomes with "people-centred" participation, which builds capacity and empowers stakeholders to define and meet their own needs.

In a critique of the above approaches, Warner (1997) disputed that neither of these categories adequately reflected the sort of sustainability objectives that participatory processes are commonly expected to meet. In furtherance of this claim, he proposed a third category which focused on building consensus (which he defined as "a condition in which all stakeholders can live with the result p. 417).

Each of these typologies offers a base for distinguishing between the methods and approaches stakeholder participation and provides a foundation for selecting the methods that are likely to be most appropriate to the purpose of the work in a given context.

4.5 Conceptualising Participation In The Context Of Community –Based Environmental Planning (CBEP)

Participation is a robust concept that varies with its application and definition. The way in which participation is comprehended in CBEP is crucial to the ways in which community is used as an agent for planning. The roles and

functionality of communities are important precepts in planning. World Bank (1995) presents participation as a matter of principle in some cases; practice for others and as an end in itself. Public participation rights play important roles in the promotion of democratic governance, social inclusion and economic development. Hence participation in environmental decision –making relates to the notion of participatory democracy and ecological justice. The term "participation" is adapted with adjectives, resulting in terms such as community engagement, citizen participation, and popular participation. Wondolleck and Yaffee (2000) identifies two distinct discourse on effectiveness and functionality of community - based approaches. These they present it as the closeness of communities to their environmental problems in contrast to the inaccessibility of government initiatives. Within this discourse, local communities have a greater say in ecosystem management than national groups as solutions emerge from a local process of dialogue and debate (Failing et al. 2007). This argument places local communities as having both the motivation and indigenous knowledge to effectively manage natural resources (Castro and Nielsen, 2001). Also an ethical dimension in empowering communities, seen as restoring harmony and balance between ecological and human systems (Bauman, 2001).

The term "community" is queried within the social science as communities forms around different shared identities. Its definition as a distinct, homogenous, spatially fixed social group is not without criticisms from theoretical and empirical perspective. Social sciences are concerned with "differences" within social entities at multiple scales, demonstrating how other forms of social identity divide so-called communities (Lane and McDonald, 2005). However, the issue of "differences" in the community is often lacking in

discourse underscoring community collaboration and the wider field of planning for environmental management (Sandercock, 1998).

The context in which "community" is defined is fundamental to the development of CBEPs. Talen (2000) identifies significant sources of CBEP failures to be its inability to recognise and understand differences in communities. The research reveals the potential for CBEP to marginalise certain groups, entrench elites and produce unjust outcomes.

The ethical premise underpinning community's participation role has theoretical implications. The assumptions which seek a balance between community livelihoods and natural ecological present a three-fold challenge: the structural narrative of human –ecological systems suggesting a linear relationship between human society and nature, is at odds with the role of dynamic humans actions and non-equilibrious ecologies (Gunderson *et al.*, 1995); the consideration of "community " as static denies the role in people in actively constructing their environment (Jabareen, 2013) ; finally the role of community in resource management concurrently promotes the centrality of community and laments its demise in contemporary social organization (Moore, 2001).

In addressing the ambiguity of defining "community", Agrawal and Gibson (1999) argue for a shift away from the "usual assumptions about communities " and proposes a stronger focus on divergent interests of multiple actors within communities, the negotiation process for diverse interests and the potential institutions that could influence outcomes (Agrawal and Gibson, 1999, p.641). Thus the research will focus on local institutions, rather than communities.

4.5.1 Objectives Of Community Participation: Why Participate?

"Discourse and critical thinking are essential tools when it comes to securing progress in a democratic society. However, in the end, unity and engaged participation are what make it happen ". Splendid Literarium by Aberjhani

The shift towards understanding participation as pathways to empowerment is illustrated by Burns et al. (1994); a modification of Arnstein (1969) he recognises the growing ideas of the communities as consumers, were choices among alternatives seen as a mean of access to power. Throughout the history of its development and in the different contexts where it is applied, participation has become encumbered with ideological, social, political and methodological meaning, giving rise to a wide range of interpretations (Lawrence, 2006).

Widespread adoption of participation across a spectrum of institutions raise questions about who is participating and for what benefit. Current visions of participation in governing aims at improving engagement of citizens in public sector. Participation in governing bodies also aims at enriching democracy by fostering liberty and equality but also, to increase transparency, enhance accountability, build social capital, advance fairness among others (Cooke and Kothari, 2001; Junker *et al.* 2007).

Given the different expositions of participation, the study identifies some different rationales, benefits of participatory approaches in decision making and policy appraisals. Fiorino (1990) categories include normative, substantive and instrumental rationales. A) normative rationale argues for a redress for power inequalities present in the form of communication between decision makers and the public. This approach looks at participation as a right thus vital for a healthy democracy. B) substantive rationale is base on the principle that decisions,

policies and assessments will automatically benefit in quality from the inclusion of a multiplicity of points of view i.e. decisions made through a rational weighing up of different positions in the light of the common interest. C) The instrumental rationales argue for participation which improves the efficiency of decision making. Fiorino (1990) includes policy as the main aim of this logic. However, the objective of an instrumentally justified process is the creation of legitimacy, seen as being attached to resulting outcomes. Wesselink et al. (2011) found other rationales for participation, they insist instrumental and legalistic rationales dominate among others. In this view, they maintain the institutional and political context in which participation takes place is an explanation for the prevalence.

Table 4.2. Participation rationales and design choices for participation

	Normative Rationale	**Substantive Rationale**	**Instrumental Rationale**
Who included	Those who have a stake	Those who have additional knowledge	Those who have blocking power and those who are needed for implementation
What included	Participants' concerns and views	Policy makers' concerns; all knowledge and views	Policy makes 's concerns; selected knowledge and views
How included	In all stage and issues	Only when it adds value substantively	Only when it ensures smooth implementation

Source: Wesselink et al. 2011

Pragmatic benefits are claimed for participation, in that stakeholder involvement could substantially improve the quality and durability of decision processes (Beierle, 2002; Reed et al., 2008); and could raise awareness of risks and

incorporate widespread ownership of the management strategies (Defra, 2004; National Audit Office, 2001). The benefits of public participation are numerous and difficult to categorise. In general, the benefits are viewed through diverse themes depending on the desired or expected outcomes of the project. These claims are broadly categorised under normative and pragmatic arguments for stakeholder engagement in environmental decision-making. Normative claims centre on benefits for democratic society, citizenship and equity. Stakeholder participation reduces the prospects that those on the fringe of the decision context or society are marginalised thereby promoting citizenship. In this light, it claims stakeholder involvement may increase the likelihood that environmental decisions to be perceived as holistic and fair, accounting for a diversity of values and needs and recognising the complexity of human-environmental interactions (Richards et al., 2004); and promoting social learning (Blackstock *et al.,* 2007).

On the other hand, pragmatic claims centres on the value and robustness of environmental decisions made through engagement with stakeholders. Here is it argued that participation enables interventions and technologies to be better modified to local socio-cultural and ecological conditions. These enhance stakeholder acceptability of management measures and in turn, improve the capacity to meet local needs and priorities. (Martin and Sherrington, 1997; Reed, 2007). Taking local interests and concerns into account at an early stage of project design infuses into project ideas and perspectives, which might help, meet local needs and priorities. The "common ground" forged and trust built between participants provides a platform to transform adversarial relationships in finding novel ways for collaborative workings (Stringer *et al.,* 2006).

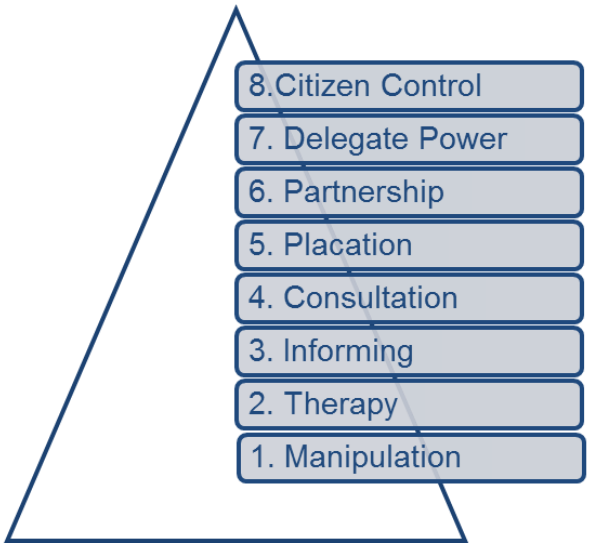

Figure: 4.6 A ladder of participation

Source: Arnstein (1969)

However, there is growing concern that stakeholder involvement may not be living up to many of the claims. There is a claim of the process and expectations of the benefits of stakeholder involvement are not clear (Kakabadse & Rozuel, 2005). Success factors for explorative strategies and adaptive management of decision-makers with and associated public participation are not well understood. Bojorquez-Tapia *et al.,* (2004), sees the tendency of the participatory processes becoming "talking shops" that could create ambiguities and delay decisive actions. Despite these concerns, there have been few attempts to investigate the validity of the claims that have been made for stakeholder participation (Webler, 1999; Beierle, 2002; Brody, 2003; Blackstock *et al.,* 2007). In the view that stakeholder involvement is underlain by a philosophy that emphasises empowerment, equity, trust and learning. Other trends of thoughts see the potential benefits to be the lesson learnt

during the participation process and argue that better understanding fosters better public and personal decisions (Irwin, 1995).

Several studies show problems associated with community engagement. These include (1) inequalities of participation (Lane *et al.*, 2004); (2) non - cooperation of communities to achieve on the ground success (Irvin *et al.*, 2004); (3) the inherent dynamics of community groups that could hamper desired outcomes.

4.5.2 Participation Context: Which Environment Fosters Participation?

It is established that community engagement is a participatory form of government that provides an enabling environment for contributions at program implementation levels. The practice of democratic norms and values like elective represented in all spheres of life, lead people and the governing bodies to share power in service delivery, a case for democracy and environmentalism (Mason, 2012). In recent years, there has been growing discourse amongst development actors and agencies on the "rights –based approach " to development, it is grounding in human rights legislation aims at achieving a positive transformation of power relations among the various developmental actors (Tomas, 2003). Within this context, international development agencies envisage that practising democracy at the central level would naturally lead to the gradual emergence of democratic institutions all over the country. Hence the practice of democracy at local and state levels is an important context for participation.

Community engagement is an important normative goal in formulating a response to climate change risk (Few *et al.* 2007). Efforts to increase public

involvement in many environmental spheres of environmental management call for logical steps for inclusionary approaches to tackling future climate risks. Adaptive actions tend to be-be scope with implications for a particular set of stakeholders and requiring a knowledge base tailored to local settings. Hence, formulating adaptive strategies has both ethical and practical value regarding inclusion (Few *et al.* 2007). Complexities associated with social and political dimensions of decision –making process are acknowledged (Rayner and Malone, 1998; Keeney and McDaniels, 2001). The identification of inherent complexities in engaging the public in decision-making is pertinent to participation in adaptation (Cooke and Kothari, 2001; Rydin and Pennington, 2000).

Public participation in the formulation of adaptive responses are explicit in several major policy documents on climate change . Participation is rooted in Article 6 of the 1992 United Nations Framework Convention on Climate Change, which calls for parties to promotion and facilitates 'public participation in addressing climate change and its effects and developing adequate responses' (UNFCCC, 1992, p.17). The Third Assessment Report of the Intergovernmental Panel on Climate Change, enumerate conditions for enhancing adaptive capacity which include 'active participation by concerned parties, especially to ensure that actions match local needs and resources' (Smit et al., 2001, p.899). The United Nations Development Programme 'Adaptation Policy Framework' provides guidelines for stakeholder engagement with a particular focus on 'grassroots stakeholder participation' (Few *et al.*,2007). Other include the International Institute for Sustainable Development which focuses on effective participation and empowerment of poor communities in the major adaptation

decisions (IISD et al. 2003, P.viii). The UK Climate Impacts Programme (UKCIP) is a UK example which discusses decision-making for climate change adaptation (Willows and Connell, 2003,p.vii).

4.5.3 Community Participation Approaches

The emphasis on "participation" became formalised in some United Nations reports. United Nation (1986:23) define community participation as " the creation of opportunities to enable all members of a community to contribute to and influence the development process actively and to share equitably in the fruits of development". Participatory development is a critical approach towards enabling communities to help themselves and sustain efforts in development work. Communities become critical stakeholders that have an important role play in the management of programmes and projects in their areas. The community development approach centres on self-help, local leadership in community revitalization through democratic processes (Barker, 1991). Several approaches suggest participation needs to be understood based on the following features: identification of appropriate stakeholder ; need identification and goal determination; information dissemination; consultation; genuine interest; public involvement in decision- making; accountability; repeated interaction; ownership and control; shared benefits; partnerships and environmental legislation (Kumar and Kumar, 2002; Sanoff, 2000; Hickey and Mohan, 2004) .

Although there is no consensus on approaches, however, some significant approaches to participation are presented.

a. United Nations Research Institute for Social Development (UNRISD) Approach:

This method focuses people power and organisation of disadvantaged groups normally sidelined by government development initiatives (Chowdhury, 1996).

b. Norman Uphoff's Team: Framework on Participation:

This approach stemmed from the need to develop practical concepts and measures of community participation in development (Uphoff,1997). It identifies four related categories: decision-making, implementation, benefits and evaluation. The approach also places emphasis on who participates, why they participated and how they participated (Uphoff, 1997).

c. Self –Reliance and Self –help Approach:

This approach aims to combine the best of community development and UNRISD ideas.

4.5.4 Participatory Initiatives In Developing Countries

With the release of the Brundtland Commission Report in 1987, narratives about environmental management and development have been merging, with conservation and development viewed as 'opposite sides of the same coin' (WCED, 1987). International development agencies (IDA) have incorporated environmental rhetoric into policy as participatory development and community –based management are seen to intersect.

Three-quarters of the world 's poorest people live in rural areas where their livelihoods are dependent on farming, pastoralism forestry and artisanal fishing (OECD, 2012). Several international development agencies (IDA) encourages

greater participation in development programs. World Bank projects like the community –driven development (CDD) programmes operate on the principles of transparency, participation, local empowerment and local capacity. Support to agriculture is recognised as an instrument for growth, vital for poverty reduction and food security (OCED, 2006; World Bank, 2007; Oxfam, 2009). Agriculture and natural resource management are crucial for developing countries as empowerment is key to success and sustainability of Developmentary initiatives for the rural poor. Agriculture connects economic growth, and the rural poor, and its importance transcend across providing incomes, poverty reduction, food availability, and stimulating growth to non-farm economies (OCED,2006). Effective management strategies must aim at strengthening capacities by supporting organisations, facilitating and institutionalising effective interactions among different interest across a range of stakeholders (OCED, 2012).

On constitutional grounds, securing access to natural resources is at the core of rural peoples' entitlements as citizens as rights over resources are often linked to memberships in local institutions, recognition of collective identities and access to services (OCED, 2012; Fisher *et al*. 2012). In the light of climate change adaptation and growing competition over scarce resources, securing natural resources and its sustainable management is vital for agricultural dependent livelihoods. Critical for sustainability is the development of better institutional and policy responses alongside capacity building. Some examples of participatory initiatives are presented:

a. Community –Based Natural Resource Mangement (CBNRM) for local wildlife and forestry in Kenya

Kenya's CBNRM is promoted as an alternative approach for managing natural resources. The country's experience shows local communities lose the right to resources when government assumes ownership and management of natural resources (Okello and Kiringe, 2004). Changes in natural resource management policy have been implemented to increase the role of communities in the management of natural resources. Collin, (2007) reviews changes and explains how CBNRM applies in the stewardship of the country's wildlife and forest resources.

b. The Bamako Initiative in Benin, Guinea and Mali

The priority of the Bamako initiative-related established in the late 1980s was to establish accountability and empower communities to take ownership of their health centres and services. Through a contractual arrangement between states and communities, basic professional healthcare was delivered via a decentralised decision-making process and management. The approach included instituting community cost sharing and co-management of health benefits; where communities were involved in managing pharmaceuticals and revenue (Knippenberg et al. 1997; Garner, 1989).

c. Historical Forest Management –Practices and Polices in Ghana

Ghana's community- based forest management (CFM) projects are established, and more prevalent in comparison to other African countries (Sackey, 2007). Former centralised natural resource approach was blamed for massive

deforestation and associated social issues linked to poverty. The involvement of local communities as well as private sector in forest management is now a principle of local forestry policy and practice. Appiah (2001) shows evidence of successes of participatory forest management, with local communities, government and private sectors involved in management.

4.5.5 Present Model Of Community Participation In Rural, Taraba, Nigeria

The current system of community participation in flood management is disjointed and ineffective as discussed throughout the previous Chapter. Nigeria operates a three-tier government: Federal, state and local, according to Ibem (2011), every tier of government is expected to build the capacity of their emergency management institution to prepare for, prevent against, respond to and recover from disaster events. It implies Federal, State, Local governments, civil society and other relevant agencies, are expected to develop their capacities in disaster management. It also implies community institutions would have to acquire disaster management capabilities as first respondents.

Research visits and interviews with relevant stakeholder verify the current management approach to be ineffective. Findings also reveal failings in structure and institutional responsibilities of the lead agency, over concentration of authority, lack of resources and logistics planning at the national level (NEMA), This is coupled with the awkward bureaucratic forces and administrative bottlenecks which hamper effective response to emergency situations and public participation.

The communities in the study area have adopted several indigenous measures such as re- routeing flood water and allowing certain farmlands to flood periodically and relocation to upland residences during floods. However, these isolated interventions could be revisited with sustainability models through the whole catchment approach to improved overall impacts for flood mitigation with considerations for socio-economic focus and poverty alleviation schemes. Furthermore, by integrating, structural, non- structural measure with community development initiatives presents bases for building community coping capacity towards climate change adaptation.

4.5.6 The Conceptual Methodology Of The Study

Disaster risk reduction (DRR) is an important pillar for sustainable development and an integral part of the World Bank's activities in sub-Saharan African (World Bank, 2010). Based on critical issues relating to flood management in Nigeria, lessons learned from other countries' experience of flooding and "best practices" in flood risk reduction (Pitt (2008); Sayer et al., 2013), the research proposes the inclusion of "soft approaches " and consideration of indigenous cultural practices as a way for developing adaptive sustainable strategies .

Developing countries like Nigeria are in dire need of sustainable adaptive strategies for flood management (Egbinola et al. 2015). There is a strong need for cooperation and sharing of experience among international river basins. Exemplified by the Budapest Initiatives on strengthening international co-operation on sustainable flood management; UNCED, Agenda 21; Millenium Development Goals (MDGs); UN Convention to Combat Desertification (UNCCD); International Land Coalition; Global Water Partnerships(GWP); World

Water Council (WWC). Lesson and best practices examples are needed for all aspects of flood prevention, preparation and disaster management.

4.5.7 Effective Community Development

Community development has a history of practice developed in many countries. The concept has changed radically over time, and this implies different ideas and practices apply in various regional context. Effective community development is defined as the development that enables a community to solve their problems with their wisdom, experience and resources with a view to eliminates poverty, pestilence and starvation (Adedokun, 2008). Effective strategies should reflect people's will in a process that helps communities strengthen itself and develop towards its full potential. Thus contextually, effective development means the pursuit of commonality and agency by adhering to the principles of self –help felt needs and participation (Bhattacharyya, 2004). Effective Community development thus means development that is desired by the people and beneficial to the community.

The field of community development contains numerous approaches with differing values, belief, goals purpose and methods, all of which are concerned with community improvement. Arce (2003) argues that effective development programs should situate community development and sustainable livelihoods approach as forms of strategic thinking based on different value orientations within the development policy sphere. Two methods are presented as essential in the field of development and value contestations underpinning community's livelihood interest and experiences. Equally, effective management from the World Bank perspectives means economically viable/ sustainable projects,

which have a positive impact on economic growth (World Bank, 2005). It has been observed that this increases people's participation in community projects.

The word 'effectiveness' Thus, given the above definitions, involves two distinctive components. One of these elements is 'normative' i.e. flood risk reduction and improved environmental management: whether the program has fulfilled the people's expectation or not. The second element is the 'instrumental' i.e. economic outcome: whether the program is economically viable or not. This research will consider the normative component when considering and define 'effectiveness'.

4.6 Conclusion

This chapter has outlined key theoretical and conceptual framework adopted for the research. It has been presented that disaster management presents unique complexities from which to explore greater social relationships and processes in society. This is tied to the understanding of social vulnerability which includes peoples' perception of flood risk and their behaviour in response to flooding. The contributions from a social constructivist perspective can help unveil the underlying socio-cultural factors in risk perception and the choice of reaction strategy. The analysis of vulnerability and resilience through the constructivist perspective and its implications for flood risk management is presented. Participation and empowerment are mutually reinforcing, community involvement within this field is established as a strategic area which could significantly enhance existing strategies but which needs to be adequately theorised to underline the significance of power relations and knowledge and vital contributor factors in this debate.

CHAPTER 5

5. CONCLUSION OF LITERATURE REVIEW

Flood Risk Management (FRM) underscores balancing flood risk, sustainable livelihoods and ecosystem services. Over the years, the concept of FRM has developed. However, implementation continues to be a challenge. In part, this reflects the perception that a risk management is more complex than a traditional standard-based approach as it involves "whole catchment" thinking, yet this is its main strength and a prerequisite for more integrated and informed decision making. It is a clear perception that flood risk management cannot be treated in isolation, but rather as a part of community development. In this context, effective SFM strategies will depend on building community's capacity to understand their vulnerabilities, activities, the role they could play in managing flood risks in which FRM activities are jointly carried out by authorities responsible for FRM, key stakeholders and the potentially affected citizens themselves.

FRM strategies will depend on active stakeholder involvement, participatory approaches and capacity building of local stakeholders towards a paradigm shift to the individualisation of risk and social vulnerability. In line with the "adaptive management approach", NFM methods and water eco-system approach services introduce some tested techniques for flood mitigation. Their approach as part of SFM has proven to be effective at mitigating flood risks at varies levels, and its use in strategic locations within the catchment contributes to reduced runoff rates. In practice, its successful application in the case study evaluated was greatly enhanced by the presence of catchment management

platform and improved stakeholder collaborations. Major challenges to NFM implementation lie within its legal and policy context; science and strategic needs; science evidence base; practicability and land -use requirements; resource and partnership needs. NFM applications for flood mitigation in Europe mainly driven by policy requirements as shared by EU environmental legislation: The Water Framework Directive, Habitats Directives, Environmental Impact Assessment and Strategic Environmental Assessment Directives as set out requirements with aims of achieving a sustainable approach to water management.

As presented in Chapter 2, NFM contributions are acknowledged as significant in reducing flood risk. However, the practicalities of NFM require coordinated collaboration on local and national levels. This presents unique challenges on varies levels i.e. social partnerships, desirable of NFM to the local community and scientific evidence for practical application and associated cost. Since NFM is dependent and community participation, there need to for an understanding of factors that influence community perspectives and choice of management options.

In understanding community choices in management, the research presents an analysis of social vulnerability and resilience through the constructivist perspective and its implications for flood risk management. Social relationships and processes in society are vital because the understanding of social vulnerability includes peoples' perception of flood risk and their behaviour in response to flooding. Community involvement and participation are mutual for adaptive planning. A strategic area which could significantly enhance existing strategies but which needs to be adequately theorised to underline the

significance of power relations and knowledge and vital contributor factors in this debate.

Adaptive flood management in sub-Saharan African is inhibited by several factors within social, technical and institutional spheres. In common with most developing countries, Nigeria faces numerous societal challenges, which often impede the investments required for developing and maintaining flood defence measures required to protect vulnerable communities. The concept of building community flood resilience has not been explored or implemented to a great extent, and very few research has been undertaken with regards to the development of participatory management for flood risks. As discussed in chapter one, several researchers have recommended an intensification of non – structural strategies of flood management, but little research has been done regarding the feasibility of applying these measures for flood mitigation in Nigeria despite the widely growing recognition of the multiple benefits of integrated flood management and its application globally.

In Nigeria, environmental management for disaster risk reduction does not exist as a formal field of practice. Instead, its scope is defined by the goals set by organisations working on related issues, such as ecosystem conservation, disaster risk reduction and climate change adaptation and mitigation. The NDMF framework makes legislative provisions for community participation in vulnerability reduction. However, in most cases, this is hardly the case. This research aims at addressing this by assessing the gaps; identify priorities of these communities to (or "intending to") facilitating the cooperation of communities with relevant authorities for adaptive planning. For NFM to be an

integral part of SFM in Nigeria, it is important that flood management frameworks designed by the government be updated to reflect current challenges of flood management in Nigeria. In this regard, steps need to be taken to address the lapses within the NDMF framework and the integration of risk reduction measures into national plans. It is vital that these schemes be focused disaster risk reduction and other associated problems like environmental degradation, climatic change adaptation and poverty alleviation. The numerous overlapping functions and responsibilities for environmental protection and enforcement within the three tiers of government limit their effectiveness in carrying out their environmental management functions. Government's role in developing sustainable strategies for flood risk reduction is crucial for effective implementation. There is thus a very real need to develop a grassroots adaptation strategy for FRM especially in low –income and lower – middle-income countries where informal settlement and flood zone dwelling is the case and the role of government in flood management is still minimal.

This study will import thematic concepts of best practice NFM applications in the UK and will adopt a quantitative methodological approach interrelating social aspects of FRM, community participation, partnership platforms for NFM, institutional and policy domains to achieve the research aim. Research techniques will comprise of literature review, field surveys and interviews. The research project will examine current management practice, public awareness and attitudes to flood management in three local government councils in Taraba state, Nigeria with an attempt to envisioning NFM strategies for Taraba state and determine factors affecting its feasibility.

This study will try to develop a methodology for NFM application for flood management in any given city of Nigeria using the case study area as an example. The study will contribute to the efficient management of floods in Taraba state, Nigeria. The social constructivist approach adopted for this research will consider the climate change implications for three local government areas and suggest a learning approach framework centred on collaborations and partnerships. This could be used to assist to critically analyse the types of impacts that CC might have on local systems and future societies and also aid in developing sustainable strategies.

CHAPTER 6

6. RESEARCH METHODOLOGY: MULTIPLE CASE STUDY RESEARCH: INVESTIGATION STEPS AND STRATEGIES

6.1 Introduction

Research methodologies are specific strategies researchers use to collect evidence necessary for building and testing theories. Scholz *et al*. (2005) define it as a conceptualised set of principles of methods and procedures developed and elaborated to tackle problems. Broadly, there is broadly three research approaches: (a) qualitative, (b) quantitative, and (c) mixed methods. These three are not clear dichotomies but represent different ends of a continuum (Newman and Benz, 1998). Qualitative research seeks to explore and understand the meaning individuals ascribe to social or human problems; the process involves emerging questions and procedures as analysis inductively builds to general themes. Quantitative research tests theories by examining relationships among variables using numerical data, analysed by statistical methods. Finally, mixed methods integrate both qualitative and quantitative data using distinct designs involving philosophical assumptions and theoretical frameworks (Creswell, 2007). This research adopts the qualitative approach. Table 6.1 presents differences between qualitative and qualitative research approach.

Creswell (2007) reiterates the value of clarifying research strategies as an effective way to increase the validity and rationally of investigations. Saunders

et al. (2012) research onion methodology as shown in figure 6.1 is adopted for this study.

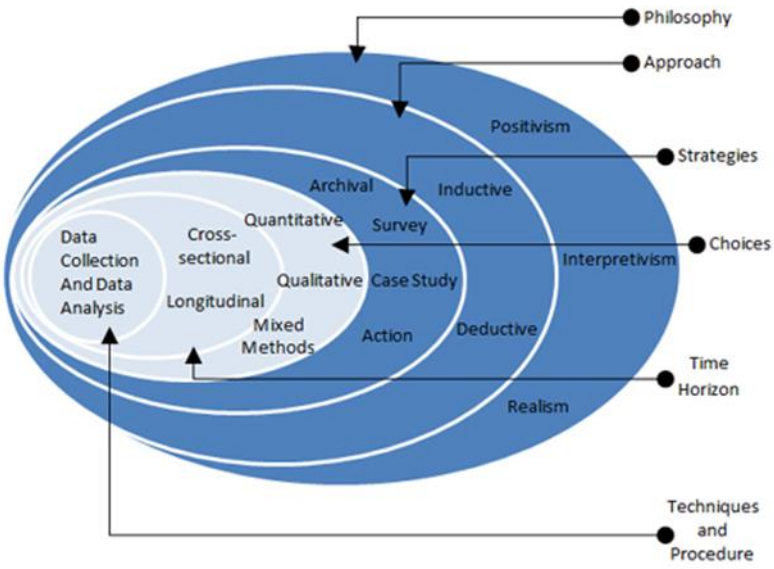

Figure: 6.1 the Research Onion

Source: Saunders et al. (2007)

The process comprises of various layers: the research philosophy, research approaches, research strategy, time horizons and data collection methods. This chapter details the research process in line with the methodology above. The data collection method strategy employed for the study is presented along with the research design justification, limitations of the study and ethical consideration. The chapter concludes with a summary.

Table 6:1 Differences between Qualitative and Qualitative Research Approach

	Quantitative	Qualitative
General Framework	Seeks to confirm hypothesis about phenomena Instruments use more rigid style of eliciting and categorising responses to questions Use highly structured methods such as questionnaires, surveys and structured observation.	Seeks to explore phenomena Instruments use more flexible, iterative style of eliciting and categorising responses to questions Use semi-structured methods such as in-depth interviews, focus groups and participant observation
Analytical Objectives	To quantify variation To predict causal relationships To describe characteristics of a population	To describe variation To describe and explain relationships To describe individual experiences To describe group norms
Question format	Closed - ended	Open-ended
Data format	Numerical (obtained by assigning numerical values to responses)	Textual (obtained from audiotapes, videotapes and field notes)
Flexibility in study design	Study design is stable from beginning to end Participant responses do not influence or determine how and which questions researchers ask next Study design is subject to statistical assumptions and conditions	Some aspects of the study are flexible (for example, the addition, exclusion or wording of particular interview questions) Participant responses affect how and which questions researchers ask next Study design is iterative that is data collection and research questions are adjusted according to what is learned

Source: Adapted from Creswell (2013)

6.2 Qualitative Research Design

According to Creswell (2003), qualitative research studies individuals, institutions and phenomena in the context that they occur. Its aims relate to understanding aspects of social life and It often answers the how and why of systems and human behaviour. The type of analysis is mostly inductive involving the identification of patterns and relationships (Wersz *et al*. 2011). Qualitative research approaches are considered open, interactive where observation precedes theory whereas qualitative methods are structured, and the theory precedes observation (Corbetta, 2003). Since the aim of the research was to explore the adoption of NFM applications within different case study catchments, the nature of data needed to accommodate the research aim was considered suited for the qualitative approach

6.3 Research Philosophy

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. It also relates to the development of knowledge and the nature of that experience. In developing and understanding new knowledge, researchers adopt different views and approaches which could be constructivism, positivism or pragmatism (Andrew et al. 2011).

- **Constructivism** is which seen as the best approach to qualitative research. It addresses the process of interaction among individuals and as such relies heavily on participants s' views as it seeks a greater understanding of the world the researcher lives and works in (Berger and Lukman, 1967; Creswell, 2007; Lincln and Guba, 1985).

- **Pragmatism,** which is concerned with what works. It recognises the different ways of interpreting the world as such it can integrate more than one research approach and investigation strategy within the same study (Creswell, 2009).
- **Positivism** termed the traditional or scientific research approach. It is highly dependent on quantifiable observations as it adheres to the view that only factual knowledge gained through observation is trustworthy. The role of the researcher is limited to data collection and interpretation (Easterby-Smith et al. 2008).

6.3.1 Application to Research

This study adopts the constructivist philosophical assumptions. As a paradigm, it suggests that learning is an active and constructive process. It is also a synthesis of multiple theories diffused into one form, which assimilates both the behaviourist and cognitive ideas (Merriam and Caffarella, 1999). The philosophy of the constructivist is that the world and reality as being socially constructed and influenced by people, a position that asserts that social phenomena and groupings are not only produced through social interaction but that they are in constant state of revision. It implies reality is socially constructed and fluid, thus what is known is always negotiated within the culture, social settings and relationships with other people (Grix, 2002). Consequently, it is concerned with the nature of knowledge, how it is created and as such unconcerned with ontological issues (Andrews, 2012).

There are two major strands of constructivist perspectives (a) constructivist perspective and (b) social constructivist perspective. Constructivist perspectives

are based on the work of Piaget who asserts that learning occurs by active construction of meaning; where individual make sense of new information by associating it with what is already known (Piaget, 1977). On the other hand, socio-constructivist perspectives developed by Vygotsky rejects the assumptions made by Piaget that it was possible to separate learning from its social context. The approaches imply the processes of knowledge is affected by other people and mediated by community and culture Vygotsky (1986). In an attempt to make sense of the social world, social constructivist view knowledge as constructed as opposed to created and where society is perceived as existing both as a subjective and objective reality.

This study adopts 'social constructivism' as its epistemological perspective which is seen to be consistent with the research nature and its aim and objectives. Adaptation processes involve the interdependence of agents through their relationships with each other which are in line with the constructionism slant which asserts that social phenomena are not only produced through social interaction but are in constant state of revision. Within adaptation debates, the social constructivist view proposes consideration needs to be turned away from trying to ascertain 'objective conditions' through more data and better science, towards understanding the plurality of constructions for management i.e. How various assertions are made, how these are related to the different interest of stakeholder groups and how outcomes are affected by power relations. With this understanding, this research maintains that areas of social constructivism are perfectly suitable in addressing issues in regards to environmental change, subsequently leading to fruitful analysis.

6.4 Research Approach

The design of the study determines the choice of investigation approach adopted. Saunders et al. (2012) present three approaches to research reasoning: inductive, deductive or abduction (scientific method). Inductive reasoning generates or extends theories (usual data to theory), whereas deductive reasoning is the opposite, occurring within existing theory boundaries where data is collected to verify the theory (theory to data). Abduction reasoning is a combination of both deductive and inductive reasoning. It involves inductively developing a hypothesis based on observations and deductively plotting their implication before testing them to modify existing theory (Walliman, 2006).

The research falls within the abduction approach as the inductive phases seeks to provide an in-depth understanding of key issues and variables for NFM processes by observing three case studies at various developmental stages. The deductive phases seek to evaluate the impact of stakeholder partnership platforms for NFM planning in five case studies to modify the tentative hypothesis produced in the inductive step. The third phase seeks to test the concept of collaborative management for NFM planning in Nigeria.

6.5 Research Strategy and Study Design

The research design provides an overall direction for the collection and analysis of data of a study; it integrates the different components of the study in a coherent and logical manner. Bryman and Bell (2003) define research design as the way data is collected and analysed based on the research questions to provide a basis for understanding the research. The choice of the study design

mirrors the decisions about the priority given to a range of dimensions of the research process (Churchill, 1979; Bryman and Bell, 2007). The importance stems from its role as a critical linkage between the theory and argument that informed the research and the empirical data collected (Nachmias and Nachmias, 2008).

Different types of strategies have its merit and associated applications. These include case studies, experiments, surveys, archival analysis and history, grounded theory and ethnographies (Yin, 2003; Croson, et al. 2007; Berg, 2004; Goulding, 2005). However, the strategy is also influenced by several factors, such as : the nature of the study, the type of investigation questions to be addressed, objectives of the study, degree of investigator control, time and resources available for the research, level of focus on contemporary events, data availability among other factors (Yin, 2003).

The literature review in chapters 2, 3 and 4 identify three main findings that informed the approach undertaken in the thesis:

(i) Flood risk management and sustainability concerns have triggered a critique of the current paradigms. Reliability and scientific uncertainty issues require a consideration of responses tailored towards mitigation and adaptation.

(ii) Sustainable development for river catchments requires an integrated approach that encourages partnerships at improving stakeholders' abilities to plan for and bring about change.

(iii) There is a need to be proactive, improve engagement and bridge the gap between the science and policy interface in real life application of NFM interventions.

Thus the case study strategy was adopted for this study. Case study methodology provides an avenue to study complex phenomena within its context. The boundaries of the cases are defining factors of case study methodology (Yin, 2009). In line with social constructivism approach, contextual descriptions are required to understand the setting or content in which the case reveals. Semi –structured interviews from two stakeholder groups as a method of inquiry for the Nigerian cases applications, applied the theoretical framework developed from the Scottish studies.

6.5.1 Application to Research

Yin (2003) guidelines for case study approach are applied. The use of "what" in the research questions, favours the descriptive approach in understanding NFM processes. The second phase of the research sought to establish relationships between NFM applications and partnership platforms. In such, the "how" questions also favour the use of the cases study approach. It links to the fact the research seeks to identify issues relating to NFM delivery in a catchment based approach and collaborative partnerships requirement that might be appropriate for further applications.

The use of case study for this study enabled the discovery of broad and rich facets of NFM applications and allowed for new understandings of drivers and barriers to application. According to Yin (2003) case, the study provides a unique opportunity for research to provide an in-depth account of events,

relationships and processes and retain the holistic and meaningful characteristic of real- life events. Furthermore, the research considered the case study method as being appropriate for the following reasons:

(i) The aim of the study is to provide an in-depth understanding of the NFM approach in sustainable flood management **(**Flyvbjerg, 2006).

(ii) The case study method could show the different perspectives of how NFM was adopted within the different case study catchments. (Yin, 2003).

(iii) The case study method could show how processes worked over time and provided insights into the cause and effects. (Yin, 2011).

(iv) The case study method could serve exploratory, descriptive and explanatory purposes (Yin, 2003).

6.5.2 Case Study Design

Yin (2003) proposes four types of case study design explicitly, holistic single case; embedded single case with multiple units of analysis; and various cases with one or multiple units of analysis.

Single case study research is most appropriate when the particular case is critical or where the single case is the representative of a large population. It is also valuable for longitudinal studies, where the case is investigated at different points in time (Yin, 2003). On the other hand, multiple case studies extend the scope of the investigation and the degree of freedom, increasing the potential for generalizability and provide more robust results (Eisenhardt, 1989; Patton, 2002). The choice of multiple cases for this study provides the leverage for cross –case pattern investigation, emerging themes and capturing novel

findings that may exist in the data (Eisenhardt, 1989; Miles and Huberman, 1994). Selection of cases in multiple case designs can be based on accurate replication where similar results are found for likely reasons; or theoretical replication where contrary results are found for likely reasons (Young, 2007). The replicable case logic was considered appropriate for the present NFM application study since the aim is to adapt and support the notion of 'best practice', the selection of the cases from a developed country and one from a developing country does create heterogeneity regarding the context of the research. Since the two cases presented are from a developed and a developing country, the 'context' for the studies in the pair of the countries will be quite different. The pair of countries will be 'matched' regarding best practice policies. Hence, the multiple- case design is adopted.

6.5.3 Case Study Selection Criteria

Thomas (2015) emphasises the importance of case selection in understanding research phenomenon. In case study research design, cases are typically selected purposively to maximise learning about the research questions. The cases selected had to provide the access required by the research, offer a diverse organisational mix and provide a wealth of information on the NFM application. As an inductive study, Billett, (1996) indicates the significance of a constructive approach with case studies is in developing an understanding of learning practices. The multiple case studies are included to increase the explanatory power and generalizability of the data collection process (Miles & Huberman 1994). Subsequently, the study had to seek out various organisational actors in each case to gain many perceptions of the NFM practice and develop an understanding of the emerging practice.

6.5.4 Case Study Selection: Theoretical Sampling

Case studies selected had to satisfy two conditions: firstly, the case studies should represent the full range of empirical variety i.e. different stages of NFM development and secondly the number of case studies had to be small to avoid undue delay in consequence of excessive data management and analysis. The cases selected had to provide the access required by the research; offer a diverse organisational mix and provide a wealth of information on the NFM application (Yin, 2003). Subsequently, the study had to seek out several organisational actors in each case to gain many perceptions of the NFM practice and develop an understanding of the emerging practice. The multiple case studies are included to increase the explanatory power and generalizability of the data collection process (Miles & Huberman 1994).

In this research, there were three phases, each phase building on the previous one.

Phase one: Pilot Case Studies

Critical case sampling was used in the first phase to investigate the NFM applications. Harmonising the desire for in-depth case analysis with time and resource constraints of the research project, the research began with an exploratory approach (Yin, 2000), with three cases at different developmental stages: namely Eddleston, Allan water and Upper Clyde. Evaluating the NFM catchments within the same region of the country offers certain advantages about the study's research questions, considerable national variation in national, institutional, political, economic, and environmental contexts.

Phase Two: Further Study

The second phases progressed with purposeful sampling in line with the research design, examining stakeholder partnerships/ platforms for NFM applications. (Given, 2008). purposeful sampling involves the research making a conscious decision about which case studies were information rich and would provide the desired information (Belford; Spey: Feshie and Dulnain; Tarland; Derwent).

Phase three: Nigerian case study application

The third phase evaluated the research output potential use in the Benue Valley (Nigeria). Table 6.2 presents the research phases, showing the analytical objectives, data collection techniques and analysis adopted for each phase.

Table: 6.2. Research phases

Research process	Case studies	Analytical Objectives	Data Collection Techniques and Analysis
Phase one	Alan Water, Eddleston Catchment, Upper Clyde Critical case sampling used to investigate NFM process. Evaluation to identify key issues relating to the establishment and delivery of NFM application. Identified common themes find observed patterns that could function as the beginning of the theory formulation.	To provide different insights on NFM application To provide a framework in understanding NFM application Thematic analysis of literature.	Desktop studies (Research reports, publicly available records, field notes) Thematic Analysis
Phase two	Tarland, Spey, Feshie & Dulnain, Belford, Derwent Expert sampling approach used to examine stakeholder partnerships/Platforms for NFM applications.	To test a hypothesis based on existing theory (Proactive partnership platforms (PPP's) enhance the acceptability of NFM applications).	Conceptual framework Concepts (partnership management platforms) Multiple points of view Thick Descriptions (how findings fit with, add to or undermine existing research and theory)
Phase three Case study interview (Nigeria)	Application to Taraba state (Benue valley) Nigeria. A deductive examination of the inter-relationship between NFM, stakeholder engagement, community adaptation and resilience building.	To describe individual community experiences and scope of ideas on flood management To describe stakeholder norms on flood management.	Semi- Structured Interviews Multiple points of views on participation and its implications for Adaptive planning.

6.6 Data Collection And Analysis

The general sequence followed a grounded theory approach. Grounded theory is good for analysing data in exploratory studies and in this case NFM application in the UK. Grounded theory (Strauss and Corbin, 1998) was used to provide insight into the factors influencing NFM adoption, NFM complexities, and barriers to implementation. The grounded theory relies on the production of theoretical perspectives stemming from data. In this respect, the researcher focused on inductive data generation and creativity to be able to interpret situations (Strauss and Corbin, 1998).

Wester (1995) steps in qualitative analysis following a grounded theory approach are applied for this study.Wester distinguishes two stages within the exploration phase. The first preparatory activities: specification of the background of study; construction of preliminary framework; specification of research questions; choice of units for analysis; and first partial data collection. The second a formulation of preliminary concepts: transcription of chosen research materials, open coding and summary of first impressions.

Pilot Phase

The primary purpose of the inductive phase was to allow findings to emerge from the themes inherent in the raw data, without the restraints imposed by structural methodologies. Desktop studies, interviews with local authorities and research visits, the research present information on science and policy needs, practicalities and partnership, need for NFM applications. The analysis began during the data collection period and was integrated into all aspects of it, including analysis of each pilot case study (Allan Water, Upper Clyde and

Eddleston). Data collection was directed by case sampling and selection (see section 6.5.4). This enabled the research to maximise the potential to discover many dimensions and conditions related to the phenomenon as possible (Strauss and Corbin, 1998). Assessments of catchment characteristics provided information about the hydrological parameters, environmental context, land use and primary flood generating process. Catchment NFM strategy identified potential NFM interventions in term of impact on flood risk and viability. Documents, including the substantial information on agency websites, research report; archival records were collected and reviewed throughout the course of the study. Ongoing record reviews before the case study visit help the researcher for lines of inquiry and follow up with specific case studies. Documents served as the primary data source. An electronic filing system was used to store and organise all documents for easy access, including website text which was copied into Microsoft documents with associated site reference information. Data for Phase one was collected over nine weeks (5 February -15 March 2012). Creswell (2002) coding process for thematic analysis was adapted for the study.

A general explanation was built to fit each case; the objective was to create an overall narrative for the three case studies. As part of a hypothesis –generating process and to develop ideas for further research, explanation building technique was used to analyse each case study and make a narrative explanation for each instance (Glaser & Strauss, 1967). (See Appendix 12).

Phase two: Further study

The use of grounded theory allowed for the establishing of themes across the five-catchment case studies, thus underlining the crucial issues about NFM applications.

Phase two progressed with purposeful sampling, evaluating five further catchments. (Tarland; Spey (Feshie & Dulnain); Belford, Derwent), examining stakeholder partnerships/ platforms for NFM applications (Patton, 2005). The key objective was to identify issues relating to the establishment and delivery of NFM application in a catchment based approach: supporting a wider adoption of the approach by detailing lessons learned from the pilots. The context for the Scottish cases studies formed the template to investigate the feasibility of NFM applications in the Benue Valley (Nigeria).

The deductive approach was applied in investigating catchment partnership collaborations in five catchments that applied NFM. The same approaches were applied to investigate partnership working in the Benue valley Nigeria.

Typically, case studies draw on multiple sources of evidence (see 6.7.1). Data collection was guided by a case study protocol which included

1. An overview of the case study
2. Different sources of information
    - Case study questions include partnership working adopted successfully by the various case studies; main activities and competencies that facilitated collaborative working; the integration of different policies and initiatives.

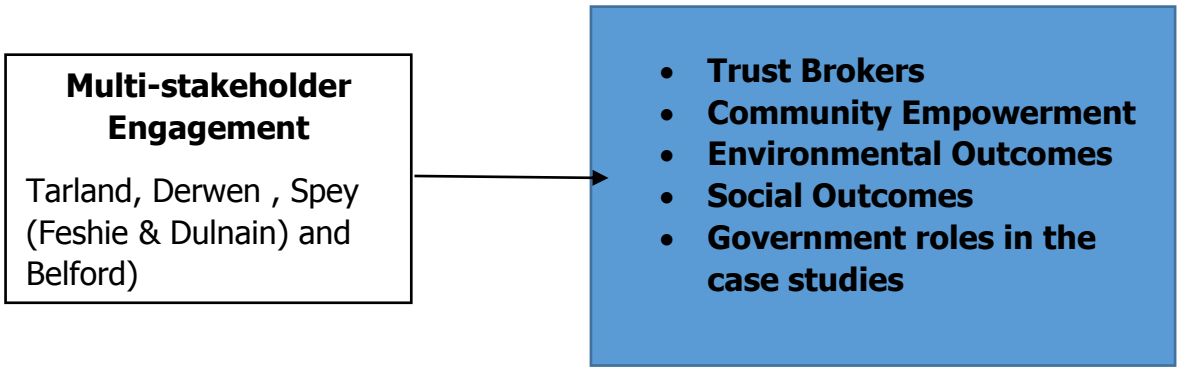

Figure 6.2: Stakeholder platforms for NFM applications

Phase three: Nigeria case study

Phase 3 began with observation on the first research study and interviews on the second. One of the merits of constructivist approaches includes close collaboration between the researchers and the participant, enabling participants to tell their stories and describe their views of reality (Crabtree and Miller, 1999). Questions covered experience with flood events, responses and understating of environmental processes from the context and settings of the locality. As discussed in section 4.2.5, the communal nature of the region and power structures informed the choice of participants included in the study using two sets of semi-structured interviews:

1. 32 community leaders (identified from government reports to be at risk of perennial flooding).
2. Eight key policymakers are responsible for flood management.

6.6.1 Semi-Structured Interviews

The use of semi- structured interviews for this study was to further develop an understanding of flood management strategies within the exigencies of Nigeria.

Interview protocol for two set of interviews helped in addressing the issues identified above. Table 6.4 and 6.5 presents interview themes for a community leaders and government agency interviews. Two set of interviews were conducted (See Table 7.1).

a. Framing the Research

The research sort to understanding flood management procedures from the community and government perspective with a view create an agenda for reform (Andrew *et al.*, 2011). Cluster sampling was used to select three local communities based on its hydrological proximity to each other, geography, flooding history and administrative relevance to the state (Bryman, 2015).

b. Designing Questions

The themes were used to develop a basic question to help understand relationships between themes and to categorise groups of related processes. Three issues considered essential for data collection: response equivalence (uniform data collection procedures in the two sets of interviews to minimise variance); the timing of data collection; status and other psychological issues). Data collection was done by the researcher and by some local researchers for the state university. The interview questions were based on initial findings from the two phases of the research. Appendices D and E provide a detailed list of the interview questions.

c. Developing the protocol

Developing a protocol was important to enable consistency and uniformity across different interviews and different respondents (Jacob & Furgerson,

2012). The use of same questions for each stakeholder group and the use of a single interviewer were done to increase the reliability of the data collected. Interviews were specifically tailored (regarding type and number of questions asked) to satisfy local needs. The interview began with background issues and gradually built to more open- ended questions. 30 mins were allocated for each interview. The interview protocol is provided in Appendix F.

d. Preparing for the Interview

An important step in planning for the interviews involved addressing the ethical and confidentiality involving human subjects. Before data collection, the research procedures for conducting interviews and protecting participant's privacy (Ethics forms) were submitted to and approved the school research office. Before the interviews commenced on the field, authorization was sort for from the respective government agencies and consent was sort from the community through their representatives. The officials acted as gatekeepers who helped to gain access to the communities.

To maintain consistency, the research group led by the researcher conducted all interviews. The open-ended questions used during the interviews were based on existing literature, government reports, anecdotal information and outputs from an earlier research visit to identify PVA's, relevant stakeholders in the water management industry and their roles and responsibilities for flood mitigation. The researcher is an indigene of the state and conversant with the social context of the area studied.

e. **Conducting the interviews**

All the interviews took place within a ten-week period. The interviews with community leaders have been carried out at their individual localities specified by the participant. This was done to ensure that participants' felt comfortable and were not inconvenienced. The local language Hausa was used in most of the interviews with the community leaders as most were not proficient in the English language. The transcript of their responses was hand written.The parallel translation was adopted as a preferred method of achieving equivalence in meaning (Hambleton, 1993). After each had been conducted, the researcher read out the impressions and observations from the interview to the participant to confirm his or her responses and ensure accurate transcription.

All the stakeholders interviewed provided valuable insights that were crucial to the success of this research study. Without inputs from key stakeholders, critical understanding and insights into the complexity of the flood management processes could have been overlooked or unintentionally left out (Bradford *et al.*, 2012).

Table 6.3 Themes for Interview Questions (Government Agencies)

Themes	Categories
1. Agency mandate and activities **C1**	• Legal responsibilities • Roles in flood management
2. Response to previous flood events **C2**	• Involvement and flood response
3. Community priorities from institution's perspective **C3**	• Flood risk perception • Public awareness and education • Local/ community input
4. Inter-agency collaboration **C4**	• Partnerships with agencies, community, and academia
5. Mitigation decision- making process **C5**	• Strategies for future uncertainty and climate change • Planning and implementation

Table: 6.4 Themes of interview questions (Community Leaders)

Theme	Categories
1. Flood history, Community vulnerability & Environmental awareness **D1**	• Residential status • Occupation and knowledge of land use • Perception of flood occurrence • Perception of severity • Understanding of the causes of flooding
2. Economic Impacts **D2**	• Monetary implications for community • Concerns and Socio-economic impacts
3. Adaptation Strategies and human management **D3**	• Local flood management strategies • Government flood intervention strategies
4. Community Involvement in vulnerability reduction **D4**	• Local participation in flood mitigation • Level of participation in management planning

6.7 Data Analysis Techniques

6.7.1 Thematic Analysis (TA)

Thematic analysis was applied for the Scottish case study to identify, analyse and interpret patterned themes within the data (Clarke and Braun, 2014; Braun et al., 2014). TA is identified as one of a range of potential methods for research synthesis and is widely used quantitative research (Thomas and Harden, 2008). The analysis is suited for social research in developing a narrative explanation for phenomena of study by categorising descriptions, explanations and relationships. It illustrates data in depth and deals with diverse subjects through interpretation (Boyatzis, 1998). TA is appropriate for analysing data when the research aim is to extract information to determine relationships between variables and also to compare different sets of evidence that pertains to various situations in the same study (Alhojailan, 2012).

The use of this method has been beneficial regarding evaluating NFM processes and applications as it allows identifying drivers, partnership and approaches adopted within the cases studies catchments. TA process analyses data without engaging pre-existing themes, which means it is flexible and adaptable to any research that relies only on participant clarifications. Creswell (2002) coding process was adapted as shown in Table 7. 6 to identify categories important for NFM applications. The process began with initial familiarisation with the data; identification of specific segments of information; labelling to create categories; reduce overlap and creating a model important categories (See table 7.6). In applying these guidelines, the method enabled the research to determine the relationships between the concepts and opinions of NFM applications and

compared with the data that has been collected. It also provided a structure, which allowed for an evaluation of the theoretical implications of the data analysis and emerging themes with regards to NFM planning and delivery. The research identified six themes.

6.7.2 Analysis Of Semi –Structured Interview Data

Semi- structured interviews provided the benefit of structure based on research interests, interview guides and flexibility allowing room for spontaneous descriptions and narratives (Brinkmann, 2014). Drawing from the analytical framework developed from the Scottish studies, 2 sets of interviews provided insights into adaptive flood management from the perspective of 8 Government Agencies and 32 Community Leaders. Community participation and multi-agency discourse for adaptive flood management, was analysed against a framework of themes (see table 6.3 and 6.4). In particular, the research explored a series of open-ended questions with accompanying queries that probe for more detailed and contextual data. Respondent answers provided in-depth information that enabled the understanding unique flooding experiences in which they communities experienced and the meanings attributed to their experiences. Government agency responses focused on the mandate for flood management, interagency collaboration, the response in previous flooding events and community participation in the mitigation decision-making process.

The research was conducted with the social constructivist viewpoint, the research methodology in NFM adaptive planning made allowances for local perceptions and values within the cases studies. Hence the knowledge sought is inseparable from the situational and communal aspects of those involved.

Analytical objectives were to describe individual community experience, the scope of ideas on flood management and to also understand stakeholder norms on flood management involved. Subsequently, all responses will be listed, considered and discussed in the analysis. The responses are further discussed against its implications for adaptive flood management, community resilience and sustainable development impacts for communities in Taraba state.

6.8 Ethical Considerations

The ethical concerns associated with this research were addressed according to the requirement defined by Abertay University's School of Engineering and Technology Research Ethics Committee before commencing with data collection.

The ethical issues about the methodology adopted include:

- Confidentially and protection of data and participants
- Participant's consent and right to withdraw.
- Use of photo

To address these ethical concerns, I took the following actions:

- Before the interviews commenced on the field, authorization was sort for from the respective government agencies and consent was sought from the community through their representatives. With regards to participant confidentiality, participant (Community leaders and government agency representative) was assigned codes instead of using their real names.

- Interviews were conducted at the participant's locality, and place of their choice and permission was sort for pictures taken.
- Details of the participants and their assigned code are presented in Table 6.6.

6.9 Summary and Conclusions

This chapter has provided an account of the theoretical and philosophical assumption underlying the research strategy and the conduct of this study. The methodology developed was considered appropriate for the theoretical approach underlying the research. The multiple case study approach is identified as an ideal approach to facilitating the use of multiple sources of information.

The exploratory phase was useful in understanding how NFM strategies were adopted in the eight-catchment cases studies. A collective case study approach allowed for an in-depth investigation of the NFM process within the case study catchment areas. Data collection techniques used includes documentation analysis, semi- structured interviews, questionnaires, the researchers' field notes of personal observations and conversations. A summary of the research process is presented in Table 6.5.

Fieldwork activities included semi-structured interviews with 8 government agencies representative and 32 community leaders. A qualitative approach was adopted in giving greater emphasis to contextual explanations. The social constructivist perspective informed the development of the research questions, the thematic and discourse analytic tools utilised complement the theoretical

framework design by providing a contextual and discursive exploration of the data collected.

Table: 6.5 Summary of Research Process

Level of Decision	**Choice**
Research Approach	Social constructivism
Research problem	Formulation of an NFM strategy to enhance stakeholder participation in the sustainable management of river catchments.
Research strategy	Multiple case studies
Research Techniques	Documentation analysis, semi-structured interviews (individuals and government groups).
River catchment areas	Allan, Upper Clyde, Eddleston, Tarland, Derwent, Belford, Spey (Feshie and Dulnain), NE Benue Valley (Taraba state, Nigeria).
Method of Analysis	Thematic analysis
Timeline	Pilot case studies–Nov 2011- Feb 2012 5 Case studies–Feb 2012- Aug 2012 Nigerian case study: Apr 2012- May 2012 Dec 2013-Feb 2014.
Subject	NFM Strategies for Adaptive flood management and Collaborative stakeholder platforms.
Output	Strategy –making themes, "grassroots" model of strategy formation. (NFM Framework)

The following chapter (Chapter 7) presents case study information and resulting themes identified.

CHAPTER 7

7. PROFILING COMMUNITY NFM EXPERIENCE IN SCOTLAND: NATIONAL POLICIES IN LOCAL CONTEXT

7.1 Introduction

As discussed in chapter 2, the development of flood management policy in the UK is influenced by increasing recurrence of floods and its impacts in both rural and urban areas. In response to these threats, has been a progress in the way flood management is addressed. The assessments of NFM contributions and its delivery in local contexts is presented. This chapter provides NFM applications in the case study catchments and emerging themes from the two research phases. The methodology described in Chapter 6 provided the baseline for data gathering. The chapter outlines case study information in Section 7.2; Section 7.3 presents themes identified from the pilot phase. Section 7.5 introduces the second phase of the research, examining partnership platforms in five catchments and finally section 7.6 present a discussion reflecting constructivist learning environment.

7.2 Pilot Case Studies: Case Study Information

During this part of the research, the main objective was to understand the NFM process against the backdrop of current legislative and policy requirements; resource and partnership needs and the practicalities of NFM. The study examined the case studies on a macro level as an expression of NFM development in society for the future (see Section 6.5.4). An evaluation structured into five focus areas:

- Catchment characteristics. (Land use and catchment size; population and Potential Vulnerable Areas (PVAs), focus and purpose of project).
- Benefit realisation (integration and delivery of multi-objectives; Main objectives the project hopes to address, economic and social drivers, NFM measures applied; multiple benefits i.e. Ecosystem services).
- Collaborative Learning (Stakeholder identification, collaboration, learning alliances and dynamic partnerships).
- Time Scales and delivery (Economic/ social drivers; length of project).
- Governing Structures (How the projects were initiated and managed, Governing structure, roles and responsibilities and Funding sources).

7.2.1 Allan Water

Allan Water, a tributary of the River Forth has a catchment area of approximately 216km^2 (SEPA, 2011). Catchment characteristics are predominately upland with critical areas of improved agricultural land, moorland and forestry. The largest potential source of flood risk in the Forth Local Plan District is from rivers, which accounts for over two-thirds of potential flood risk (SEPA, 2011). Potentially vulnerable areas (PVAs) are the towns of Dunblane, Bridge of Allan and some downstream villages. A study in 2011 (SEPA, 2011) estimates 340 residential and commercial properties to be at risk of flooding by a 1 in 200- year event with an estimated damage in the region of £12.5 million.

An options appraisal process identified 19 potential options and further streamlined to a detailed quantitative assessment of four most desirable options. River Knaik riparian corridor (see fig 7.1) was adopted as the pilot

project to include riparian planting consistent with Local Biodiversity Action Plans and the Forestry Commissions potential Native Woodland Network. The option was chosen based on the economic implications, local preferences (community identified the river as the dominant contributor to flooding risk) and its potential to serve as a sub- catchment demonstration project.

Figure: 7.1 River Knaik

Source: Researcher's field work pictures

7.2.2 Eddleston

A restoration strategy for the Eddleston Water was developed with the aims of restoring natural habitats and reducing the risk of flooding to Eddleston and Peebles (Werrity et al., 2010). It focused on three main areas of the valley, characterised by the source, pathway, receptor model. The project included measures like re-meandering, planting riparian woodland and floodplain forests, setting fences back from the banks, introducing large woody debris, reducing stocking levels, blocking ditches and locally creating ponds and wetlands. The

projects have progressed to monitoring phases to include surface, ground water and Ecological monitoring (Eddleston update, 2012). Eddleston water (see fig 7.2), a tributary of the Tweed joins the main river at Peebles. Downstream communities of Eddleston and Peebles at risk of occasional flooding, the catchment was selected as a trial scheme to pilot physical works and to test the social and economic aspect of delivering NFM on the ground.

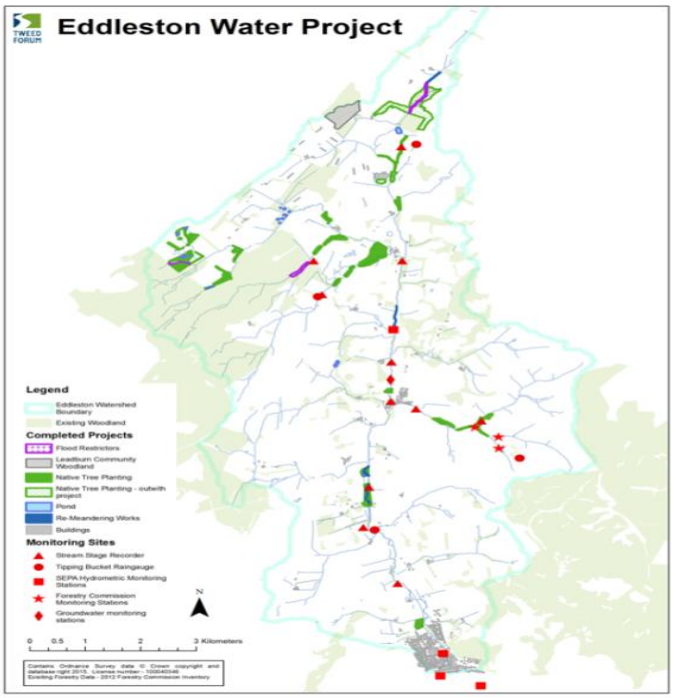

Figure:7.2 Eddleston Catchment

Source: Tweed Forum (2011).

7.2.3 Upper Clyde

The total catchment area of the Clyde to Blairstown is 1,700km2. The Clyde rises in the Lowther Hills, south of Abington, with the Daer water and Potrail water tributaries. Significant areas of the upper catchment are rural, either

natural or semi –improved pasture and forest plantation, with urban areas being tiny proportion generally towards the downstream end of the reach. The study had a multifunctional approach where opportunities for NFM, quality of water body and biodiversity benefits were considered. Much of the Upper Clyde catchment has a floodplain which has been developed for agricultural use rather than housing or industry. 29 potential NFM interventions were identified within the seven major tributary catchments upstream of the critical areas of Crossford, Rosebank and Dalserf, through a GIS and desktop study. Initial screening and consultation reduced the number to 14 interventions to be progressed. Qualitative assessment considering impacts on risk, social impact and environmental impact was carried out to provide a short list of 4 options.

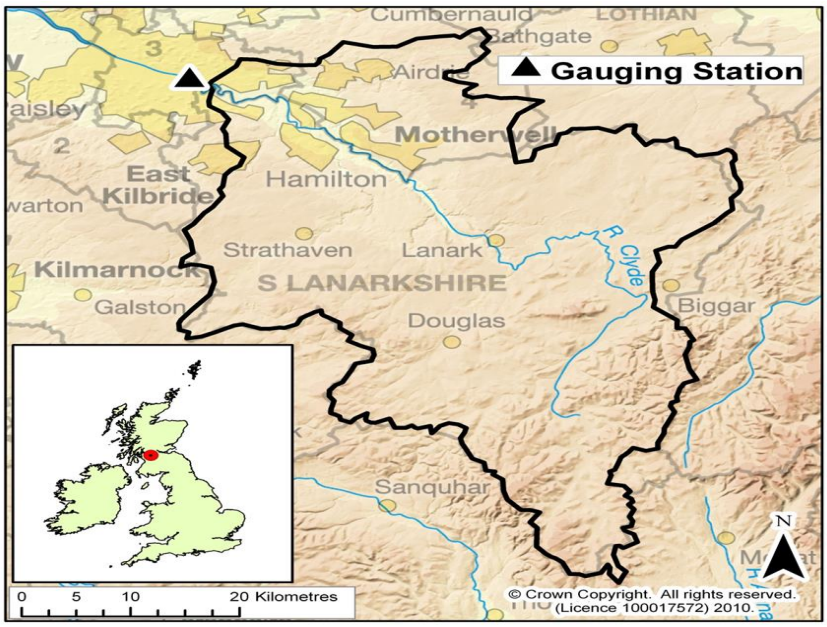

Figure: 7.3 Upper Clyde Basin

Source Online: http://data.ecn.ac.uk/sites/sites/largermaps/R13.jpg (Accessed 5/06/2015).

Figure: 7. 4 Flooding in the Upper Clyde

Source: Researcher's field work pictures

7.3 Analysis from Pilot Case Studies

The review was undertaken to identify whether key factors (such as land use, catchment size, history of engagement, project time life and stakeholder collaboration) had an overall influence on the applications of NFM in the catchment. The NFM pilots were widely agreed by regulators and stakeholder participants to have been successful. Although the upper Clyde and Allan projects did not go beyond the scoping studies, and the four options considered worthy of developing further (Upper Clyde) were based on their impacts on local flood risk; the merit of developing a demonstration site and to contribute and gather data on NFM techniques. The process overall was beneficial for understanding and contributing knowledge for NFM applications for the future. Within a year, the pilots were able to generate a sense of partnership at the local level, leading (in most cases) to the production of scoping studies towards viable catchment plans.

The range of organisations that hosted the pilots largely met the common aims and objectives set in the initial proposals. Pilot hosts adopted many innovative and tailor-made approaches to meeting these objectives. In most of the studies, the key stakeholders were able to develop bespoke tailored plans based on pre-existing collaboration and their understanding of catchment issues. This on its own was advantageous and was important to the success of the scoping and implementation stages. Evidence have emerged through the projects of increased emphasis on the ecosystem approach.

All the studies were defined by hydrological boundaries and the catchment based approach has proven to be a successful scale for planning and activities based on management of natural processes, this allowed the integration of local issues and consideration of other administrative interactions (for example, the Upper Clyde where the catchment is geographically located within several local authorities). This approach enabled the incorporation of potentially disparate objectives and the realisation of multiple benefits across the administrations, sectors and stakeholders involved.

The need to develop co-operative water and land management strategies to tackle the challenges of increasing flood risk embraces a similar requirement for integrated catchment management at a global scale. Communities of practice emerge through considerable social discourse. These interactions explore new models for catchment management centred around local knowledge and understanding.

7.4 Themes from Pilot Case Studies

This section identifies themes common to these case studies. The studies were initiated at different times, differed in many ways, a range of organisations provided funding and technical support. Despite different aims and objectives, the studies share common themes that inform our understanding of the nature and design of proactive management. All the scoping studies had generic steps which included stakeholder identification; catchment characteristics; project aims and objectives; flood risk assessments; legislative and policy; identification of potential NFM interventions to be applied; project policy integration and adaptation goals. Catchment NFM strategy identified response options regarding the impact on flood risk and viability. The research identified six themes at the end of the study:

(i) Legislative and policy drives

(ii) Use of Comprehensive Approaches

(iii) Creativity and Innovation in management options

(iv) Multiple Benefits, Multiple Funding Sources

(v) Multi-stakeholder Engagement

(vi) Collaborative learning.

The themes presented here were seen as key to understanding NFM in the current implementation context and helpful in determining next steps for strategic planning. Table 7.1 presents the coding process in identifying NFM themes.

Table 7.1: The coding process in thematic analysis

Initial read through text data	Identify specific segments of information	Label the segments of information to create categories	Reduce overlap and redundancy among the categories	Create a model incorporating most important categories
NFM Scoping studies Research report Website Publicly available records Field notes	Many segments of text	Climate Change Adaptation Sustainable flood management Policy / legislation EU Directives/ WFD Social directions in flood risk management Stakeholder involvement Community-based flood risk management River restoration Prioritisation of sites Socioeconomics Baseline catchment characteristics No of stakeholders Data requirements Evidence from monitoring Aims of study Identifying data gaps Statutory bodies Problem identification / structuring	**1.** Adaptive management **2.** Ecosystem approach **3.** Catchment characterisation **4.** Problem structuring /Identification **5.** Stakeholder identification **6.** Stakeholder preference **7.** Data requirement **8.** Identifying interest groups	**1. Legislative Drivers (T1)** **2. Comprehensive Approaches (T2)** **3. Creativity and innovation (T3)** **4. Multiple Benefits, multiple funding sources (T4)** **5. Multiple – stakeholder engagement (T5)** **6. Collaborative Learning (T6)**

Adapted from Creswell (2002)

7.4.1 Legislative and Policy Drives (T1)

Although sustainable flood management was at the heart of these studies, Legislative drivers seem to be the driving force in all case studies. These include compliance with the Water Framework Directive; the need to adapt to climate change; pressure to integrate NFM within the sustainable development agenda and shift towards a broader trend towards 'community ownership' in natural resource management.

7.4.2 Comprehensive Approaches (T2).

Stakeholders within the catchment developed bespoke tailored plans based on pre-existing collaboration and their understanding of catchment issues. Evidence show increased emphasis on the ecosystem approach, especially when applied strategically to specific parts of a system as seen at the Eddleston catchment where multiple measures were conditioned by local context and opportunity (e.g. re-meandering, setting back fences, introducing large woody debris, creating wetlands and planting riparian woodland along the River main stem.

7.4.3 Creativity and Innovation (T3).

All the case studies considered multifunctional approaches and avoided single – solution by extending their efforts beyond existing, conventional institutions and regulatory authority. For example, the Source-Pathway-Receptor framework was used in the Eddleston, critical assessment of the review materials showed the current position of knowledge and science on land use management and its impact on flood generation within the catchments. In particular, the Eddleston studies tried to assess what was known about the effects of afforestation

/deforestation; field drainage of different types; and agricultural cultivation techniques on runoff generation. The study also tried to distinguish the consequences of change, over historical time frames using documentary and cartographic sources. Local folklore was also useful in understanding historical changes in land use within the Allan water catchment.

7.4.4 Multiple Benefits, Multiple Funding Source (T4).

All three studies leant towards integrating "soft approach" and, ecosystem restoration programs as part of the multi-scale management portfolio. Driving factors addressing water quality concerns, economic development, flood mitigation, and others merged into the case studies. Meeting multiple objectives with a single project eliminated the need for separate projects that would otherwise be required. All three studies incorporate ecosystem restoration programs in one form or another. Studies had multi-functional approaches to address catchment issues. (See: Table 7.1). Flood protection and WFD requirements where the key focus in all the catchments. Other problems included diffuse and point source pollution from urban and rural sources, habitat restoration, water resource protection/ quality improvement and preservation of natural heritage. Some considered a broad range of additional benefits harnessed from the scoping reports.

7.4.5 Multi-Stakeholder Engagement (T5).

NFM applications require coordination of local, state agencies as well as the input of competing interest groups. An equitable and thoughtful process is essential in multi-stakeholder coordination as is apparent in the Eddleston and Allan catchments. The Flood Risk Management (Scotland) Act 2009 requires

stakeholder participation in sustainable flood risk management, which includes a requirement to pilot physical works and test the social and economic aspects of developing these new policy directions. Eddleston catchment considered the acceptability of measures and the involvement of local communities in delivery on the ground. The first phase of the research addressed the scoping stage to propose a programme of how this might be delivered. The second aimed at habitat restoration and natural flood risk management. Alongside the multi-scale approach, these case studies engage with a diverse set of stakeholders.

7.4.6 Collaborative Learning (T6)

Two out of the three studies engaged with the public in some way. Eddleston, in particular, had pre-existing partnership platforms for the management of catchment issues, negotiated financial support and acted as liaisons between the public, the scientific community, government agencies. The Tweed Forum (Eddleston catchment): A stakeholder management group was formed in 1991 to promote the sustainable use of the whole of the Tweed catchment through holistic and integrated management. An integral part of the Allan Water study was consultations with local landowners and other stakeholders to ascertain the potential and interest for implementing natural flood control measures within the catchment. These discussions lead to the acceptability of the River Knaik riparian corridor pilot project.

7.5 Summary of Pilot Phase

Several factors influence the development of NFM strategies. The objectives of the evaluation were to examine whether the key factors (i.e. land use, catchment size, history of engagement, project time life and stakeholder

collaboration) had an overall influence on the applications of NFM in the catchment; and to examine the effectiveness of stakeholder collaboration. All the three scoping studies had generic steps, which included stakeholder identification; project aims and objectives; catchment characteristics; flood risk assessments; legislative and policy drivers; identification of potential NFM interventions to be applied and project policy integration and adaptation aims.

The Eddleston catchment benefited from a coordinated and strong functional stakeholder base. The project built a strong partnership, with a Project Board led by Tweed Forum, SEPA and the University of Dundee. The project was supported by a wide range of Steering Group including Scottish Borders Council, British Geological Services, Scottish Natural Heritage, Forestry Commission Scotland, National Farmers Union (Scotland), Tweed Foundation and the Environment Agency. Pre - project consultation involved an invitation to all potentially interested groups and targeted individuals in the catchment before the onset of field work.

Though the Eddleston was the smallest of the three, it benefited from a coordinated stakeholder base to test the social and economic aspects of developing new policy directions, including the acceptability to the local communities involved in delivering such improvements on the ground. The presence of pre-existing partnerships has proven to be helpful in promotion the catchment based approach to NFM as seen in the organisation, governance and delivery of the Eddleston Water project. Similarly, the development of the Allan project was managed by a Steering Group with representatives from the Forestry Commission Scotland & Forest Research; local councils (Perth & Kinross, Stirling); RSPB; SEPA, SNH. Other key stakeholders include 11

members representing a spectrum of land-owner categories who were consulted early on the lifespan of the project. Two UK projects undertaken in similar environmental settings to the catchment provided valuated insights and contributed to its implementation.

The Upper Clyde Natural Management Scoping study commissioned in 2011 was lead by only two stakeholders namely SEPA, and the South Lanarkshire council. The study outlined a comprehensive methodology and had a multifunctional approach where opportunities for NFM, quality of water body and biodiversity benefits considered. Consequently, the non-involvement of wider stakeholders affected the study's feasibility through landowner consent and buy-in.

All the studies (except the upper Clyde) had some public engagement. The process of project delivery is considered as important here as the environmental improvements that are introduced. The studies are judged not only regarding the efficacy of the environmental improvements but also by the extent to which stakeholder engagement and inter –agency working have been efficient and the degree to which the learning outcomes have been identified or achieved.

From the evaluations, the significance of pre-existing partnerships in the collaboration process was highlighted as most significant. The value of early engagement in the context of environmental improvements cannot be over stressed. Local politics and history in terms of engagement with those bodies with flood management powers must be taken into account at the onset of the projects. Evidence from the pilot studies show the improved benefits of having

a "figurehead or honest broker" acting as a coordinating link and spearheading the advancement of the projects. The presence of these partnerships largely contributed to the overall success of these projects.

Overall, across the pilots and the catchment initiatives, there was good representation from the public, private and community/voluntary sector, with a wide range of stakeholders involved from each. Beyond engagement with the stakeholders, seven of the pilots and initiatives engaged with members of the public who were not involved in organised groups. Allan, in particular utilised information from telephone conversations with additional farmers and businesses within the catchment.

Bearing in mind that many of the projects summarised here are still work in progress. Monitoring results over significant timescales need to quantify the "successes" of the environmental improvements being sort. Some of the interim observations on the management approaches that lead to the success in realising multiple objectives can, however be made. The involvement of a wide and diverse group of stakeholders and the public appears to be a prerequisite to developing and implementing NFM projects. The presence of pre-existing partnerships significantly added value to NFM applications. Early engagement with local stakeholder is important as ultimately, the initiatives are expected to become self –sustaining in the future .

From the above, the research study sort to understand the partnership platforms needed to support NFM by laying out a tentative Hypothesis: ***Catchment Partnership platforms enhance the acceptability of NFM applications.***

7.6 Further Study

7.6.1 Introduction

This phase of the research examines successful partnership platforms in five catchments where NFM applications were implemented. The case study allows for cross-case analysis while simultaneously linking these platforms to the wider emergence of non-governmental actors and power relations (Reed, 2008; Allen *et al*. 2011; Cook, B. R. *et al.* 2013). The rationale and case study selection are discussed in section 6.8.

The need to develop co-operative water and land management strategies in tackling increasing flood risk embrace an interrelated requirement for integrated catchment management at global scales (Ferrier and Jenkins, 2010; Hooper, 2005; Roger and Hall, 2003). Holistic perspective incorporates technical and traditional knowledge about natural systems and values ecological, economic and social concerns involving a range of stakeholders (Reed *et al*. 2006). Communities of practice emerge through social discourse and construct their perspective of the world based on individual experiences and views (Feldman *et al*. 2006). Interactions explore new models for catchment management centred on local knowledge and understanding. Sequel to the discussion on community participation in section 2.2.3, co-management arrangements between public, private and social players upheld as the way forward in the light of sustainability aspirations. Since stakeholders represent different interests, it anticipated a wider spectrum of water management issues at catchment scales could be covered, facilitating and negotiating trade-offs.

Catchment management is currently undergoing a transitional change in which top –down approach is being challenged by a local organisation and communities promoting collaborative decision making. (See section 2.4.1). Within governance, policy shifts towards integrated management embracing community involvement; effects of the global economic recession inhibiting traditional, capital- intensive interventions through the reduction and relocation of resources (Harvey, 2010; Fitton *et al.* 2014).

This study draws on the experience gained in the PMPs Integrated Catchment Management in five catchments, funded by multiple sources. The next section will introduce the benefits of PMPs as in their roles as "Go-betweens" linking these platforms to the wider advent of not –governmental actors (Reed, 2008; Allen *et al*., 2011; Cook *et al*., 2013). PMP's are advocated for as institutional bargaining spaces that could be useful for visioning and information exchange. From the same viewpoint PMP and their multiple variants such as Multi-stakeholder platforms (MSPs), are presently the aspirations of the international water sectors i.e. the International Water Management Institute (IWMI), International Water Association (IWA). Despite the popularity of this "multi-benefit approach", Joseph (2002) argues, very few processes have been developed to facilitate problem-solving among multiple stakeholders who have diverse and often conflicting interests in natural resource management.

However, Warner (2006) argues for realistic expectations of multi –stakeholder platforms, stating that initiators of platforms for stakeholder involvement in water management should be very explicit on what the participatory process aims at and can realistically achieve. This research seeks to contribute to the

development of a framework for multi-stakeholder in NFM applications for environmental management, highlighting the social aspects in the light of adaptation and resilience.

7.6.2 Case Study Catchment: Partnership Platforms

7.6.3 Spey (Feshie & Dulnain)

Spey Catchment Initiative established in 2003 with the aim of providing a strategic framework for the wise and sustainable use of water resource. The project began in late 2010 and the process involving local stakeholders in a capacity exercise to raise awareness of the Flood Risk Management (Scotland) Act 2009 and establish potential benefits and barriers to stakeholder implementation of the legislation. The initiative established through a focussed implementation phase, where water management issues informed the development of a catchment management plan from five consultative stages. Top priorities for action include:

- Planting riparian woodlands and enhancing wetlands
- Demonstrating natural flood management techniques
- Control of invasive non-native plants and animals
- Understanding how the whole river system works
- Education, awareness raising and getting people involved in the catchment.

Apart from legislative drivers, economic and social factors influence the choice of management options for water management issues. Illustrated in the Spey catchment where the threat of flooding was not much of a priority but had massive impacts on the local economy. Areas of focus where recreation/

tourism industry; distillery industry; fishery management; its selection as a Special Area of Conservation; being part of the Cairngorms National Park and the implementation of the EC Water Framework Directive.

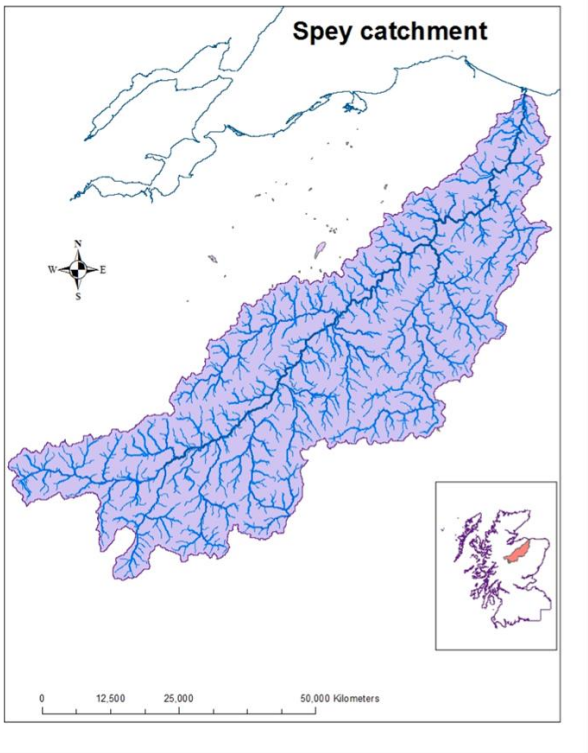

Figure: 7.6 Spey Catchment

Source: Spey Fishery Board (2015)

7.6.4 Tarland Burn: Aberdeenshire

The ongoing Tarland catchment Initiative developed as a partnership venture between researchers, land managers, regulators, and the local community. An essential element of establishing, prioritising and agreeing to intervention works in the Tarland catchment has been the inclusion and involvement of the catchment stakeholders (Langan, 2006). Three levels of participation created according to stakeholder's level of interest and stake in the catchment. These

classifications were presented in the form of an action card clearly showing the objectives, roles and responsibility of each sector. The areas include government agencies; land businesses; fishing, angling and fish ponds; the built environment; business and industry; household and local community; tourism and recreation and Aberdeen Harbour. (Cooksley, 2007). This gave the advantage of increased ownership; raised awareness and capacity for resources required for the projects. Critical to the success had been heightening awareness within the community of the environmental problems and the potential for enhancing the water- courses as an asset.

The study was part of the 3 Dee vision project, (see fig: 6.2) a Scottish contribution to a major environmental project with regional partners in the Netherlands, Norway, Denmark and Sweden. The catchment has been the focus of research at John Hutton Institute (JHI) for over 12 years. This was in response to policy driven requirements that was aimed at linking hydrology, water quality and ecology to provide catchment scale demonstration sites where techniques in Natural Flood Management (NFM) could be evaluated through monitoring and modelling. Key elements of the project are the engagement with the local community and other stakeholders, encouraging development and ownership of the pressures on the environment and the solutions through capacity building within these groups (see fig 2). The initiative was also in line with the increasing emphasis on both an international and national context of partnership working to deliver integrated river basin management (European Environment Bureau, 2001).

The initiative benefited from rich and diverse stakeholder basis which lead to the establishment of implementation groups (Dee Catchment Partnership) (see fig.6.2) where the prioritisation of options was done through participatory workshops. It also had a partnership venture between the scientific community, land managers, regulators, the local community and secure INTERREG project funding from the EU. Stakeholders included the Aberdeenshire & Aberdeen City Councils, Dee District Salmon Fisheries Board, the James Hutton Institute, Cairngorms National Park Authority, Forestry Commission Scotland, and Government regulating agencies, land managers, local communities and private individuals.

Figure: 7.7 The River Dee catchment showing sub-catchment (Tarland)

Source: Aberdeenshire Council, (2008)

7.6.5 Derwent

The Derwent catchment partnership was hosted by the West Cumbria River Trust with partners from the Woodland Trust, Environment Agency, agricultural land managers, local communities and local district councils worked in partnership to develop a Catchment Flood Management Plan which took into account the social, economic and environmental issues prevailing in the catchment River Derwent catchment flood management plan: The Woodland Trust, Environment Agency, agricultural land managers, local communities and local district councils worked in partnership in 2009 to develop a Catchment Flood Management Plan which took into account the social, economic and environmental issues prevailing in the catchment.

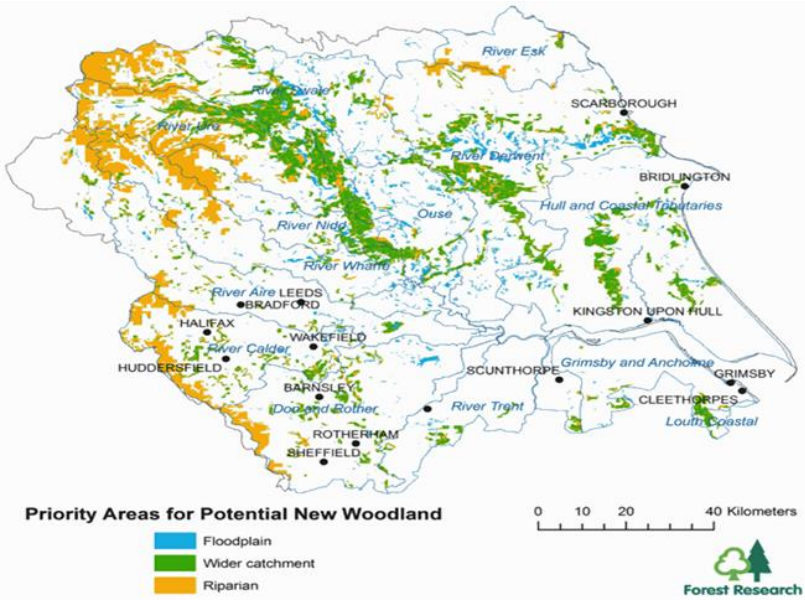

Figure: 7.8 Derwent Catchment

Source Online:

www.forestry.gov.uk/images/YandH_flooding_map.gif/$FILE/YandH_flooding_map.gif (Accessed 1/06/2015).

7.6.6 Belford

Belford Proactive Solutions established in 2007 by the Environment Agency North East Local Levy team and Newcastle University created the "Belford proactive flood solutions", a partnership to address flood problem using Runoff Attenuation Features. The local community played vital roles in the delivery of the project.

Being a small rural catchment with a low number of properties at risk, funding from the Northumbria Regional Flood Defence Committee, the Environment Agency North East Local Levy team and Newcastle University financed the project. The social network analysis approach informed stakeholder analyses were the local communities (farmers, residents in the catchment and visitors to the catchment) and relevant stakeholders were consulted. Their involvement played a vital role in project delivery. Stakeholder meetings before catchment interventions allowed the communities to highlight issues within the catchment and react to proposed interventions. Community meetings are scheduled to take place in Belford over the next few years to evaluate community perception about the project.

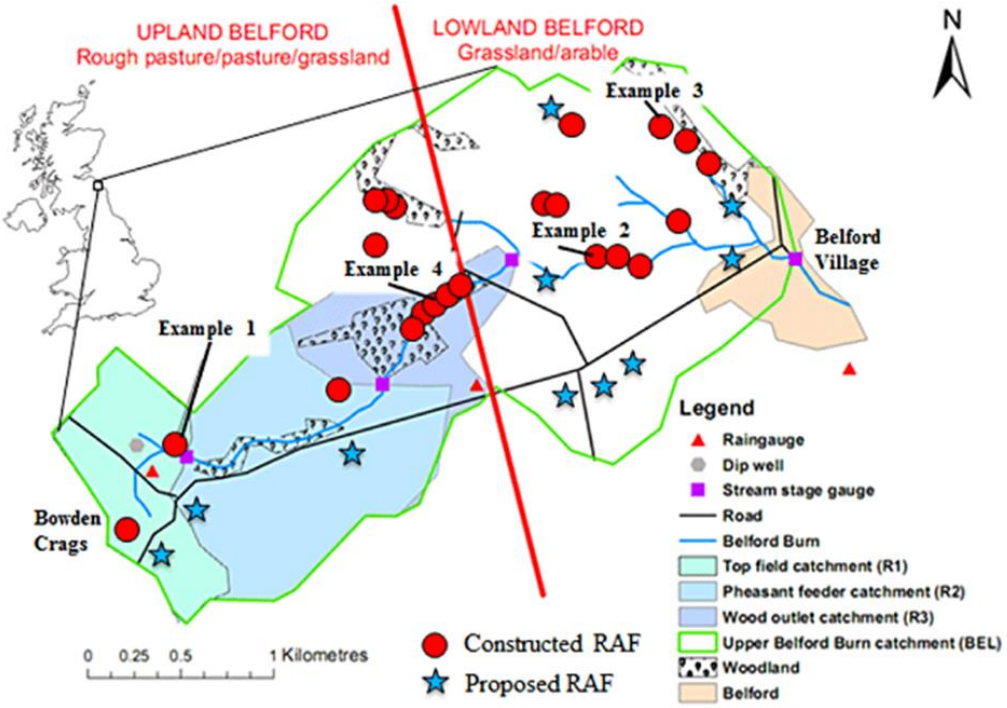

Figure: 7.9 Map of upper Belford Burn showing locations of RAFs constructed (circle) and proposed (stars)

Source: Modified from Wilkinson *et al*. (2011).

Table: 7.3 Summary of Case Study NFM interventions

Catchment	Objectives	NFM Interventions
Eddleston	To develop a catchment restoration strategy designed for flood mitigation at the towns of Eddleston and Peebles.	A detailed survey of a restoration strategy developed using the source, pathway, receptor model.
Allan	Flood mitigation at Dunblane, Bridge of Allan	Identified priority areas for catchment restoration.
Upper Clyde	1. To assess the potential for using NFM techniques to reduce flood risk. 2. Improve water and explore other biodiversity benefits.	A multifunctional approach considering the quality of water body and biodiversity benefits.
Spey (Feshie & Dulnain)	1. To demonstrate integrated catchment scale management by protecting and restoring nature features. 2. To raise awareness and understanding of the whole river system and engage with stakeholders and communities. 3. To further develop the Spey catchment partnership.	Riparian Woodlands creation, Enhancing Wetlands and runoff management
Derwent	Flood mitigation in the towns of Keswick, Cockermouth and Wigton.	A multi-objective management plan which considered the needs for agricultural land drainage, flood risk management and ecosystem enhancement.
Belford	To protect Belford from flooding by improved channel maintenance	Farm integrated runoff management plans (FIRM). To "Slow, filter and store water at source".
Tarland	To address issues of flooding in Tarland and Aboyne, improve water and habitat quality of the catchment	Sustainable flood storage strategy for the Catchment

7.7 Discussion

The research draws together these case catchments outlining problem resolution with the aim of recognising the qualities, presumptions and approaches that these partnerships associate with success. While the research endeavours to contrast the experiences of the organisations from similar contexts, within the interpretive slant, it is imperative to note that the catchment pressures/ issues, demographics, economies and histories of engagement differ and produce various examples. The research also identifies patterns and similarities regarding origin, objectives, approach, funding, relations with government and the challenges being addressed. Despite the difference, the organisations all stemmed out in response to local problems. The social realities of communities shape the action which they take within this reality and in response to coevolving social, economic and ecological concerns. Adaptive management or "learning by doing" offer opportunities for proactive and collaboration approaches to resolving environmental problems. This observation is consistent with the growing consensus that adaptive management is the most appropriate methodology response to environmental policy problems associated with complex adaptive systems (Marshall, 2012; Susskind & Camacho, 2012; Djalante et al., 2011). For example the Tarland Catchment Initiative began in response to water quality and pollution concerns linked to agricultural activities and waste water treatment; the Spey Catchment Initiative evolved from the desire to protect its pristine water resources being that it is important for the local economy; the Woodland Trust in the Derwent catchment by woodland creation following devastating floods experienced in the North West of England and similarly Belford proactive solutions where

alternative catchment based solutions were sought as traditional flood defences were unsuitable for the catchment.

In response to local challenges, each of the organisations developed objectives for intervention into land and water management practices. For some, their aims were made clear strategic objectives/ frameworks i.e. Spey Catchment Initiative, while others adopted a less formal approach, offering site-specific and advisory service i.e. the Derwent catchment. The organisations differ in their access to funding, but despite these differences, there is a significant common emphasis on innovative efforts to secure funds from multiple sources.

Some key issues emerged directly out of these case studies. First, the case studies show that the organisations both directly and indirectly played a "broker" role to position themselves between individuals (i.e. local scale) and decisions makers (i.e. regional and national levels), thereby, earning the trust of both parties. A second key lesson is that during the initial engagement process, local inputs were considered for management options and as a result, community's recommendation and management options were considered. This was probably the most significant benefit in each case. Though, it is not clear from these cases the scale at which the engagement worked best. Thirdly, outcomes of collaborative management allowed the consideration of a wider range of control options, trade-offs and thereby facilitating mutual benefits for the parties involved i.e. "win- wins". The outcomes are not distinctive to the case studies, but their frequency is indicative of prevailing trends and also adds to the growing discourse on collaborative catchment management (Marshall et al. 2010; Marshall, 2012; Cook et al. 2012).

7.7.1 Trust Brokers

Catchment management decisions based primarily on biophysical factors can polarise people, making policy processes more divisive than usual. The case studies all describe a similarity in management approach: problem identification, deliberations on management options, concessions reconciled and solutions implementation. As a result, trust is earned in the process, and this forms the foundation for further catchment based engagement. Confidence is seen here as the key determinant of the case studies (Irwin, 1995; Cvetkovich, 2013). For example, within the Belford catchment, the North East Local Levy team and Newcastle University created a partnership to address the flood problem using soft engineered runoff management features. Stakeholder meetings before catchment interventions allowed the communities to highlight issues within the catchment and react to proposed interventions. The conclusion of this work gave rise to the concept of Catchment Runoff Management Plans, which manage flow pathways directly by storing, slowing and filtering runoff at source on farms. In the Spey catchment, an informal Steering Group of the key regulatory bodies was formed, this group comprised the Spey Fishery Board, Scottish Natural Heritage, the Scottish Environment Protection Agency, and the Highland and Moray Councils. Initial public consultation in June 2000, and sought people's views on the key issues affecting the waters of the River Spey catchment. This phase was followed by more in-depth consideration of these issues by five Working Groups, whose recommendations for action formed the basis of a consultative draft Catchment Management Plan, launched in September 2002. The Working Groups comprised representatives from a wide range of interests within the catchment.

The public consultation on the draft Catchment Management Plan elicited distant views and comment from a broad cross-section of interests, which has helped to shape the final Plan.

Following the devastating floods experienced in the North West of England, the Woodland Trust in partnership with landowners (including others such as the Catchment Sensitive Farming officers, the Derwent Rivers Trust and Environment Agency) helped landowners restore their riverbanks and farmland through tree planting. These woodland creation projects helped stabilise river banks, slow flood water and reduce the likelihood and impact of floods.

Similarly, the Tarland Catchment Initiative (part of the Dee partnership) a partnership venture between researchers, land managers, regulators, and the local community with aims of improving water quality and increase awareness of catchment management through sustainable land management practices. The implementation of simple pragmatic measures (e.g. buffer zone creation, bank stabilisation, soft engineering to increase channel habitat diversity, livestock fencing) led to demonstrable habitat improvement. To engage the community, there had been a need to undertake capacity-building exercises to introduce the concept of catchment management. Perhaps as crucial in its success, the initiative encouraged participation from catchment stakeholders.

7.7.2 Community Empowerment

Discussions in Section 4.4.1, recognises community involvement as indicators for monitoring progress towards sustainable development and environmental management goals (Fraser *et al*. 2006; Hezri and Dovers, 2006). Participation as a relevant indicator proposes to provide some key benefits (Bell and Morse,

1999; Pretty, 1995) (see section 2.4.5). Research shows local engagement may help build community capacity to address future problems and the value of this could significantly outweigh the results of the actual development projects since the local input is necessary to measure what is locally relevant accurately. The responsibility for decisions and actions is distributed across a range of actors/ and interests and is increasingly visible in political agendas aiming to encourage local decision-making (RELU 2011). The trend towards community participation was common in all four case catchments studies and offers interesting comparability despite each coming from slightly different social, economic and environmental contexts.

In the Belford catchment, stakeholders were consulted throughout the project and were a vital part of the delivery of the project. Meetings before catchment interventions allow the communities to highlight issues within the catchment and react to proposed interventions when in turn helped produce a catchment flood plan using a range of runoff storage features, attenuation zones and flow control structures in partnership with farmers and landowners. The engagement process help develops a shared vision for catchment management centred around local knowledge where the local community through a bottom –up approach had an improved understanding holistic catchment management. There is little doubt this process resulted in real environmental governance changes.).

The Spey catchment management plan evolved in five stages with an initial public consultation seeking the local opinions on the leading water resource management issues (see section 7.6.2). The evaluation of the development of

the SCMP suggests that the substantive benefits of such processes include a more holistic understanding of the underlying issues, leading to the better conceptualisation of the management challenges and, therefore, better solutions (Blackstock and Richards, 2007)

7.7.3 Environmental Outcomes

The perception that collective action in solving complex problems is best pursued through nested systems, including collaborative structures, may be essential, but the institutional design of such systems in particular settings is itself complex. The internal dynamics of collaboration pose several challenges, some related participant (who gets involved) and others to what the initiatives realistically can achieve. Most of the partnerships platforms studied here satisfied their mandate and produced the acceptable environmental outcome and quality changes. The Derwent partnership promoted reforestation practices and ecosystem restoration. Communities in the Belford catchment maintain that the flood attenuation feature contributed in flood mitigation and sediment controls (Wilkinson et al, 2011). The Tarland success stories have been the focus of water quality research at the James Hutton Institution for over 12 years. Eddleston Water, a typical 'failing' water body in Scotland, reports on the development of a restoration strategy using a whole catchment approach to community participation and the achievement of a range of other ecosystems service benefits (Eddleston update, 2012). Improvements have been made in Rivers in the Spey catchment by the re-naturalising of straightened burns and reconnecting of local floodplains. Water quality has been improved by removing diffuse pollution pressures. Allan water has progressed to a pilot phase where river restoration enhances the understanding of the science and helping

address practical implementation issues. Although the research cannot demonstrate from any of the case studies that collaboration leads to particular environmental quality outcomes, it is apparent that cooperation activities can promote environmental change.

7.7.4 Social Outcomes

Improved environmental quality and management are the motivation for most PMP aspirations, another consequence of these activities are that they can create social issues which in turn influence a future environmental outcome. A social issue such as trust, enhanced communication and improved policy awareness have been attributed to collaboration (Wondolleck and Yafee, 2000; Cortner and Moote, 1999; Beierle, 1999). Across the cases studied here, relatively logical social outcomes emerged including, the building of trust, increased knowledge and understanding, network ties and enhanced communication among stakeholder groups. As a result, many of the cases show collaborative efforts could generate good relations and provide the initial steps for developing new and enduring partnerships.

7.7.5 Government Roles In The Case Studies

Evidence show Legislative drivers are the main fulcrum for NFM measures in flood mitigation (see Section 3.2) within the case studies, various environmental and social outcomes link to regulatory roles. In all cases, government institutions and actors affected results in important, though varied ways. For example, Belford proactive solutions were in collaboration with the Environmental Agency; the Spey catchment initiative works closely with the Scottish Government and various other agencies; Tarland catchment action has

a steering group comparing of SEPA representatives and Aberdeenshire Council. As institutions, government mandates and guidelines substantially influenced environmental outcomes. For the government –led and government–encouraged collaborations, regulatory standards determine specific criteria that the case studies were supposed to meet. Across all five cases, government as the regulating body contributed to outcomes by providing information and expertise, securing resources and carrying out plans to be implemented (see Appendix F). Importantly, governmental actors helped even in the case where a government was following an effort developed by non-governmental actors i.e. Derwent. Additionally, government influences served as conduits between the collaborative efforts and those agencies and institutions. Institutions played a somewhat different role in spurring collaborations in Belford where funding for a traditional flood-defence scheme could not be justified. As a result, a flood prevention scheme using soft engineering run-off management features was developed.

7.8 Summary

Collaborative and cross–sector governance is considered essential for integrated and adaptive management regimes in response to dealing with the complexity of social-ecological systems. This is based on the premise that building partnership capacity amongst relevant authorities and resource users provides a critical basis for overcoming collective action problems and achieving strategic objectives (Drew, 2005). Several factors influence this gradual shift towards the adoption of a decentralised and participatory form of governance, following nearly a century of centralised, expert –led and technically reliant approaches (Pahl-Wostl et al., 2007; Blackstock and Richards, 2007; Selsky and Parker,

2010; Cook et al ., 2013). As a result, collaborative decision-making evolves from the continued processes of social learning. In these processes, stakeholders at different scales connect in flexible networks that allow them to develop the capacity and trust they need to collaborate with a broad range of formal and informal relationships ranging from formal legal structures and contracts to informal, voluntary agreements (Pahl-Wostl et al., 2007). This could lead to successful project outcomes through community ownership of the project goals and empowerment in project implementation. The next chapter examines partnership platforms in the Benue Valley, Nigeria.

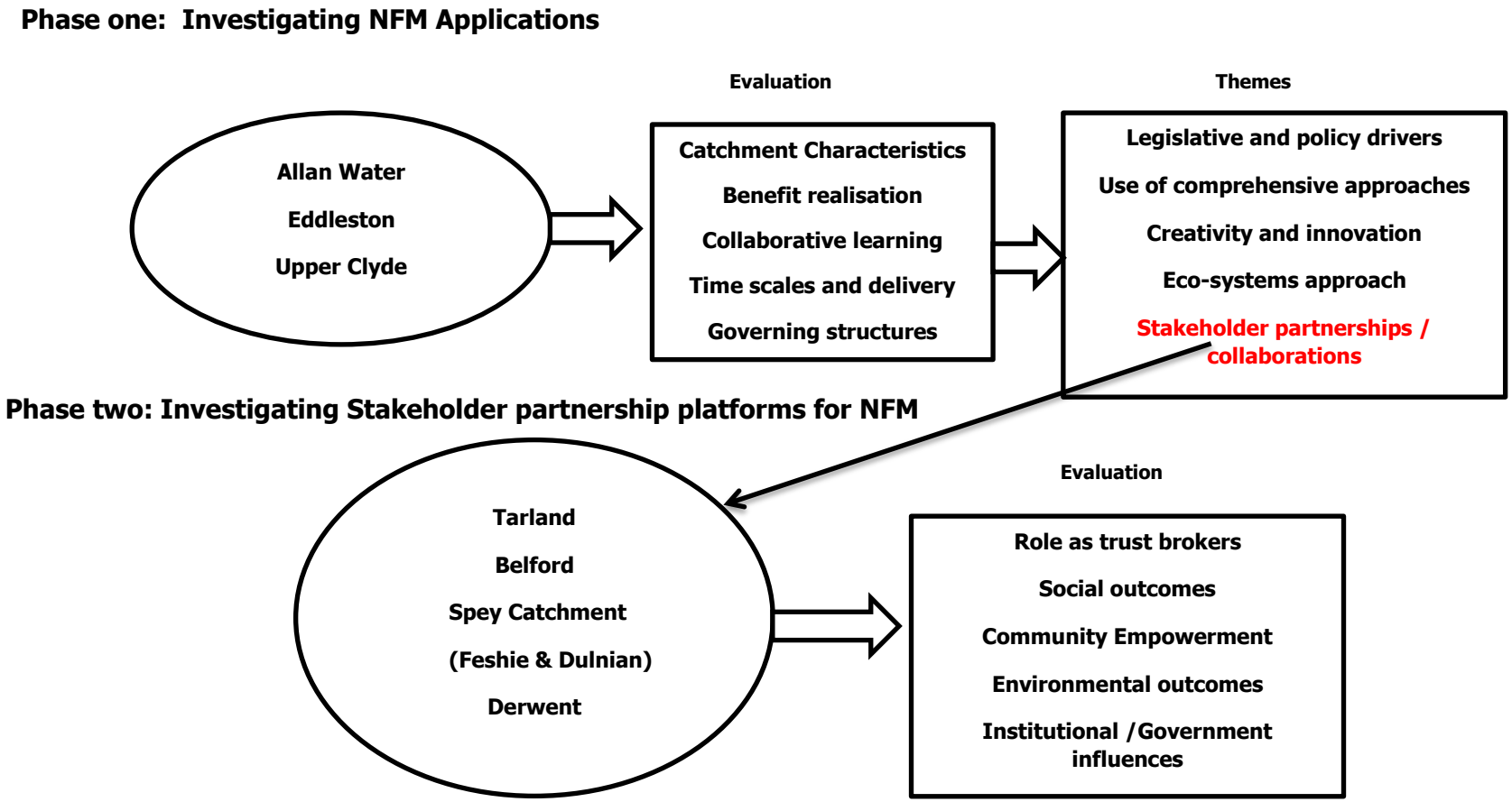

Figure: 7.5 Schematic representations of Scottish case studies and resulting themes

CHAPTER 8

8. SEARCHING FOR PARTICIPATION: PARTNERSHIPS PLATFORMS IN THE BENUE VALLEY

8.1 Introduction

This chapter investigates inter-agency interactions and flood management procedures in Taraba state (UBVN). It was intended in part to provide information needed for the sustainable management of floods and to explore the feasibility of promoting NFM as a sustainable option for flood mitigation. As discussed in (section 3.4) most flood management strategies in Nigeria are responsive with minimal focus on vulnerability reduction and community resilience (ECOWAS, 2006; Cervigni, 2013; Obeta, 2014; Adebayo, 2014; Odemerho, 2015). It is against the background of current risk and vulnerability reduction literature which emphasises the importance of increasing adaptive capacity and resilience of populations exposed to natural hazards (Manyena, 2006; Keim, 2008; Pelling, 2012; Blaikie and Cannon, 2014; Odemerho, 2015). Furthermore, there are few studies in Nigeria that address factors influencing adaptive capacity, resilience to floods and subsequently few proposals for possible adaptation pathways.

Sequel to discussions in Chapter 7, the prospects of collaborative partnerships in addressing complex flood management problems through the integration of government agencies and social perspectives is deliberated for the Benue Valley through a case study/ interview methodology. Two sets of interviews for eight government agencies responsible for flood management and 31 local community heads within three local councils (see section 6.7). The aim of the

Nigerian phase was to investigate situations reflecting a constructivist learning environment likely to promote NFM applications through local scale engagement with relevant stakeholders. (See section 1.3).

Themes from Scottish Studies

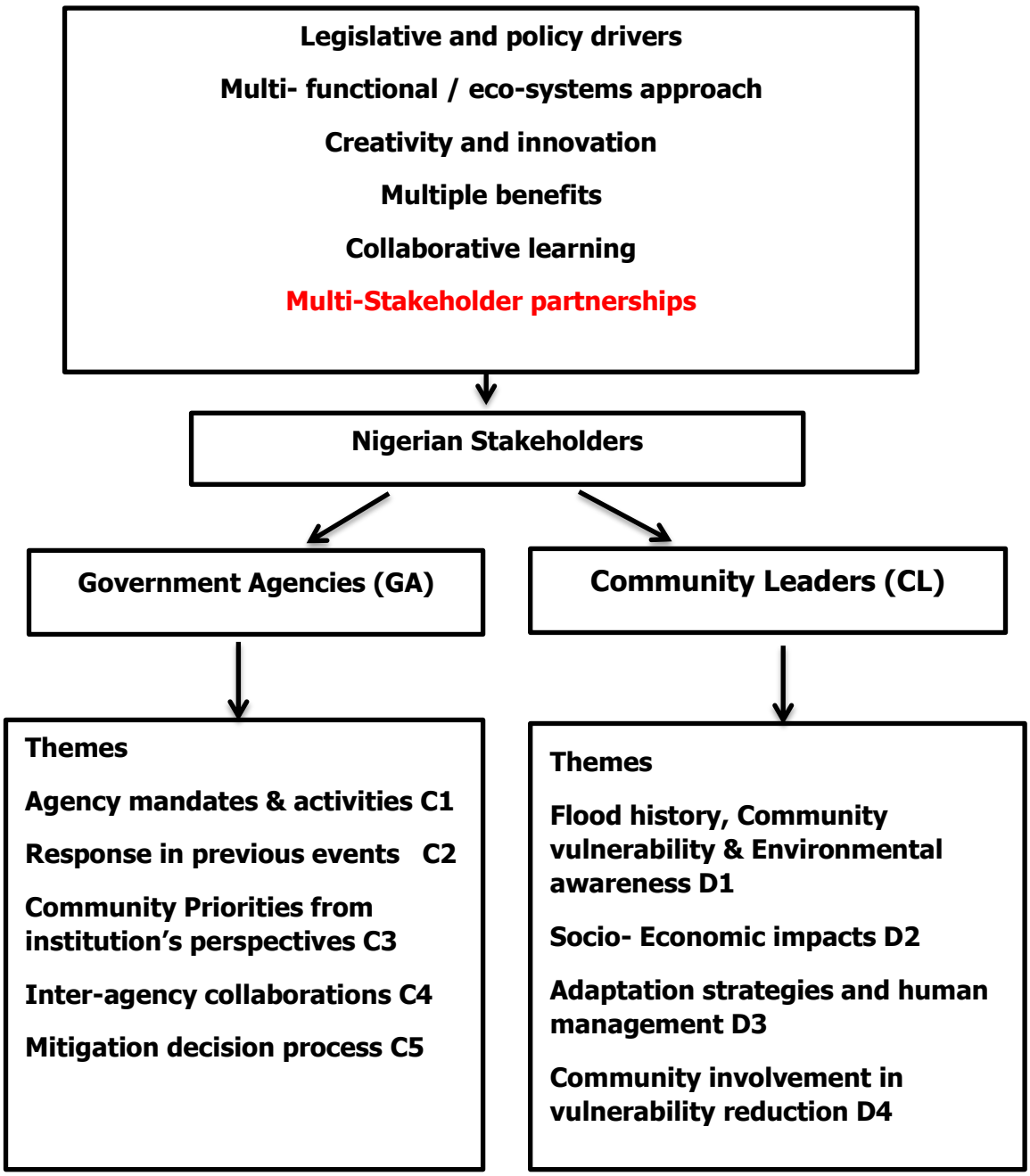

Figure: 8.1 Scottish themes applied to the Nigerian cases study

8.2. Documents Obtained

These include official mandates for flood mitigation, rainfall data, land cover and flood assessment reports from 2008, 2009, 2011 and 2012 (see Appendix G). The agencies include:

(i) Upper Benue River Development Authority Yola (UBRDA)

(ii) State Emergency Management Agency (SEMA)

(iii) Taraba Environmental Protection Agency (TEPA)

(iv) Taraba State Ministry of Environmental & Urban Development (MEUD)

(v) State Ministry for Water Resource (MWR)

8.3 Interview I (GA)

The first interview covered 8 government agencies (GA1- GA8) responsible for flood management. Information on Agency mandates; response in previous flooding events; mitigation decision making and inter- agency collaboration was sought to understand the current flood management scenario in Taraba state. The institutional approach, as used in this study, refers to government response procedures which include policies, regulations and guidelines. The questions were coded under four themes namely: Agency mandate and activities (C1); Community participation (C2); Inter- agency collaboration (C3) and Mitigation decision- making process (C4) (See figure 8.1). Table 8.3 presents the interview questions under each category.

Table: 8.1 Profile of Interviewees

No	Stakeholder type	Description
CL 1-32	Community leaders Lau(7); Ardo kola(6); Jalingo (19)	Community leaders in the case study area. Flood victims who live directly adjacent to lush floodplains of the River Benue and Lamurude. The main occupation includes agricultural activities and fishing.
GA 1-3	Policy makers at local level Lau/ Jalingo/ Ardo-kola	Senior policymakers in local Government councils who are the first responders.
GA 4	Disaster management "coordinator."	Coordinating agency for disaster management has mandated management to coordinate with other stakeholders
GA 5	Catchment FRM Planner	Policymaker at the state level. Lead Environmental Protection Agency
GA 6-8	Policymakers at the state level	Health care provider; Watershed Planner; dissemination information agency

Source: Fieldwork (2013/2014)

Table: 8.2 Response Categories 1 (GA)

Coding framework	Categories
1. Agency mandate and activities **C1**	• Legal responsibilities • Roles in flood management • Involvement and flood response
2. Community Participation **C2**	• Flood risk perception • Public awareness and education • Local/ community input
3. Inter-agency collaboration **C3**	• Partnerships with agencies, community, and academia
4. Mitigation decision- making process **C4**	• Climate changes adaptation • Planning and implementation

Table 8.3: Interview questions and categories for Government Agencies (GA)

CATEGORY	QUESTIONS
Legal responsibilities	**Q1**. What government agency do you represent? **Q2**. Under the current legal and policy requirements, what are your agency responsibilities in flood mitigation? **Q3**. In the previous flooding events, what was your agency's response? **Q10**. What are the current challenges your organisation faces in the implementation of flood management plans and how do you hope to address these challenges?
Community Participation, Public awareness and education	**Q8.** Has there been any effort to involve the vulnerable communities in the planning process? **Q9**. A recent report by NEMA identified vulnerable communities and stressed the importance of flood risk perception what efforts your agency has made towards public awareness and education? **Q11.** In your opinion, what is your view on the current system and how can it be improved regarding proactive approaches, adaptive management, flood resilience and sustainability
Inter-agency collaboration	**Q4**. Does your agency work alone or do you partner with other government agencies for flood mitigation? **Q5**. Do these partnerships involve local leaders, community-based organisations, civil society groups, the media and the academic communities?
Mitigation decision- making process	**Q6.** What are your agencies strategies for flood risk management and how does this plan integrate future uncertainty and climate change? **Q7**. How has this improved the planning and implementation of the flood mitigation in Taraba state?

Results from Interview 1

8.3.1. Agency Mandate and Activities C1

Legal responsibilities and role in flood management.

The first question asked the respondents, to provide information on their institution involvement in the floodplain and flood management these included formal mandates or guidelines. Formal mandates supported by legislation were mentioned for two respondents: The State Emergency Management Agency (SEMA) and the Ministry of the Environment and Urban Development (MEUD). However, SEMA's role embraces a role as "coordinator" (government parastatals establish to exercise general supervision and coordination over all matter relating to the environment). The agency's responsibilities cover emergency management that covers a broad range of other disasters like i.e. communal conflicts, drought, rehabilitation and provision of relief materials in times of crisis. While MEUD is principally responsible for environmental management (flood mitigation and control inclusive). The local government councils as first respondents in flood disasters describe their mandates with terms such as "emergency response, assessment of damage and provision of relief materials; maintenance of water waterways; identifying safer areas within the community for evacuation during flood events" among others (GA1, GA2, GA3). Another agency stakeholder noted an ambiguity in their responsibilities in flood management as quoted below:

"……. for now there seems to be no clearly spelled out functions in the absence of the Department of Irrigation and Dams which is the anchor department but which is not situated in the ministry, thereby creating a huge and avoidable

disconnect of needed and effective collaboration with the Federal Ministry of Water Resources, (MWR)…."(GA7, 07/02/2014).

Two other stakeholders indicated their responsibilities to be in ad hoc duties in times of events (GA6, GA8).

Involvement and flood response

Key government agency operational roles in flood responsiveness are MEUD and SEMA. When asked to reflect upon their responses to previous flooding events, MEUD responded:

"…….. the ministry, identified critical areas, designed and constructed stormwater drainages. This effort is a continuous process". (GA5, 7/02/2014).

SEMA responses included:

"……Search and rescue and provide relief materials: relocation of victims, the establishment of IDP camps; Evacuation of victims". (GA4, 10/02/2014).

Local councils mentioned measures mostly in remedial responses; identification and relocation of internally displaced persons (IDPs) to safer areas during events; search and rescue; registration of internally displaced people (IDPs); first aid; provision of relief materials, food items and collaboration with stakeholders (police, red cross, civil defence , health personnel's, NGO, volunteers, fire service) among others. Others include treatment and sensitization on seasonal disease and infections associated with floods (GA6); information dissemination for flood awareness through the media i.e. radio and television jingles (GA8). Table 8.4 gives a summary of responses and frequencies under agency mandates and activities (C1).

Table 8.4 Government Agencies Responses C1

Summary of Responses	Frequency
Roles in Flood Management	
Remedial works, maintenance of drainage and waterways	**3**
No spelt out functions/ No set responsibility	**2**
To create awareness, Rescue victims of flood, Relocation of victims, Rehabilitation and provision of relief materials, Early warning alerts	**1**
Flood management and mitigation	**1**
Not specified but called in terms of disease and epidemic control in IDP's.	**1**
Involvement in Flood Management	
Coordination of vulnerable communities and first respondents	**3**
Because of unclear responsibilities, the ministry worked as a part of the team which identified areas already affected and proffer ways and methods of intervention.	**1**
Search, rescue and coordination of all stakeholders	**1**
Identified critical areas, design and constructed stormwater drainages.	**1**
Treatment and sensitization on seasonal disease and infections associated with floods.	**1**
Information Dissemination	**1**

8.3.2. Community Participation, Public Awareness and Education C2

The second section (C2) addressed community participation and local input in flood management planning. The GA5 response shows some communities were consulted during the planning process but did not state which community or flooding period or year. The agency also declined to comment on efforts made towards public awareness and education. On its view on the current system and improvements regarding adaptive management, flood resilience and

sustainability, the response includes improvement in budgetary provisions to address flood disasters. GA6 & GA8 declined to answer questions on community participation and referred to SEMA. GA4 response on community involvement centred on the post-disaster response: "…..Yes, especially in the area of camp management in identifying suitable locations and decisions that border the internally displaced persons. (IDPs)" (GA4, 10/02/2014). On efforts towards public awareness and education, response state effort is continually made by advocacy visits to relevant stakeholders; Sensitization and training of volunteers; Signing of a memorandum of understanding (MOU) with other stakeholders for prompt response in an emergency situation and Coordination or stakeholder meeting with partners. GA7 responded by stating vulnerable communities were always involved in the planning process and response to awareness and education:

"…..There has been an increased magnitude of response to issues bordering on flood risk and control through proactive efforts with relevant stakeholders in the state such as the Taraba state Emergency Management Agency, Ministry of Agriculture, Ministry of Environment and Urban development, Taraba state Environment Protection Agency, local government councils, civil society organizations, the media, FMWR and the UBRBD"…. (GA7, 07/02/2014).

GA1 response states vulnerable communities were involved in the planning and implementation process, and its agency considers partnerships, public awareness and education as a necessary tool towards mitigating and reduction of flooding in the state. GA2 on community participation …"Ideas are being

sorted in some cases, but it's not a formal process".. (GA2, 06/02/2014). GA3 response indicates in- formal participation but states

"…….plans are under way to involve the communities thru the community associations and clubs (GA3, 06/02/2014). Table: 8.5. Presents Government Agencies responses and frequencies in C2.

Table: 8.5. Government Agencies Responses C2

Summary of Responses	Frequency
Community Participation / Local community input	
vulnerable communities involved in the planning and implementation process	**1**
Ideas are sort in some cases but not a formal process.	**1**
Not formally but plans are under way to involve the communities thru the community groups	**1**
At all times vulnerable communities are involved in the planning process.	**1**
Yes, especially in the area of camp management and in identifying suitable locations for IDPs.	**1**
Government asked the communities on their plight, needs and areas that government could assist (Records available).	**1**
Declined to Respond	**2**
Public Awareness and Education	
Agency has considered partnerships, public awareness and education as necessary tools towards mitigation and flood reduction	**1**
Flood alert signals sent to local counsellors to inform the populace of expected flood event.	**1**
We partner with SEMA and the Ministry of Information to inform vulnerable communities in an event such as flooding	**1**
There has been increased magnitude of response to issues flood risk and control through proactive efforts with relevant stakeholders	**1**
Advocacy visits to relevant stakeholders and sensitization and training of volunteers.	**1**
Decline to respond refers to SEMA	**1**
SEMA is the agency responsible for coordination	**1**
Improving partnership awareness through Public sensitization and education	**1**

8.3.3. Inter- Agency Collaboration C3

On collaboration, seven out of eight agencies indicated partnerships with another state, federal, private sector organisations and NGO. Currently, one Agency (SEMA) is responsible for coordinating. Significant points, which emerged from the interviews and reports, analysed show partnerships, and collaborations were hastily organised after major flooding events. In turn, these partnerships become functional after major incidents. Similarly, emergency meetings of stakeholders held immediately after the floods of 2009, 2011 and 2012. (See Appendix G, no. 8, 24, 27, 28, 29). Table 8.6 present government agency responses in C3.

Table 8.6 Government Agency Responses C3

Summary of Responses	**Frequency**
Inter-agency Collaboration	
We work in collaboration with SEMA, Red Cross and security personnel's	**1**
The partnership involves community leaders, information department of the local government council, community audit department, works and housing and primary care department.	**1**
Yes, we partner with the state government thru the Taraba State Emergency Management Agency, Federal agencies and some NGO.	**1**
The local partnership involves community-based groups and leaders but not with the academic communities.	**1**
The Ministry partner with government agencies and some non-governmental organisations	**1**
Yes, in planning and intervention approach. Partnership with government agencies, the private sector, NGO's, CBO's, FBO's. e.t.c.	**1**
We partner with the Ministries of water resources; Rural water supply Agency; UNICEF and NGO i.e. Doctors with Borders.	**1**
Not Applicable to agencies mandates	**1**

8.3.4. Mitigation Decision-Making Processes C4

Strategies for Vulnerability Reduction

When asked to reflect upon the agencies strategies for flood risk management and how these integrate future uncertainty. The response was unanimous: the decision-making process is currently 'disconnected and disjointed' (GA7); driven by 'agency and sub-agency' mandates and activities (GA5); other interviewees also felt that the provincial government and its departments dictate the process. One respondent also noted that residents had not been fully integrated into the flood management process since their opinions were not considered before and during the floods of 2005 (GA3).

Current Challenges and Barriers to Sustainable Flood Management /planning and implementation

The respondents identified some factors militating against the adoption of effective flood/floodplain management in the study area and strategies for addressing them. Responses indicate one of the most oft-mentioned challenges was inadequate funding for activities that would increase sustainability; one municipal informant linked this with 'unwillingness' and 'short-sightedness' of government and specifically the result of a lack of 'long-term funding and vision' (GA3, 06/02/2014); and the ad hoc nature of how the agencies handle flood crisis. Time was a key issue as respondents cited the time interval between flood events and the lack of political will and continuing obligation by the government. Others include a lack of cooperation by the vulnerable communities to leave the flood prone/ flash areas; while the agency wishes to address the issues by involving the community leaders and volunteer in the

sensitization and awareness campaigns (GA1, 05/02/2014). However, no specific strategies for community engagement were mentioned.

Another challenge often mentioned was the lack of strategic planning and basin-wide approach to water issues. Linked to this were comments about the little drainage management and lack of cooperation on community scales. Others include weak coordination between the major stakeholders; improper placement of relevant departments; the dearth of personnel skilled in environmental management (GA4, 10/02/2014).

Of all interviewees, one from a provincial agency had a different emphasis in what he perceived as barriers to sustainable floodplain management. His suggestions included that the obstacles were: 'those who do not understand risk'; unrealistic expectations that people have that they can be protected no matter what the circumstances, and; people using their personal criteria in decision making rather than 'risk-oriented criteria' (GA4, 10/02/2014). (About the Socio-cultural belief and values attached to locations where communities refused to relocate despite being offered alternative areas by government). His suggestions express a perception of a socially constructed underestimation of risk.

On challenges of SFM, GA4 suggests proactive approaches include the strengthening of institutional capacity through strategic reorganisation; improved focused on a community –driven participation with government support; the incorporation of disaster risk reduction into developmental efforts; finding a balance between structural interventions and traditional systems. The desire for improved communication and expedited decision-making were central

to these suggestions. It further suggests that more comprehensive, action-oriented plans need not only detailing but also to be 'sold' effectively to the executive arm of government at the highest level and that someone or some organisation needs to take on that pivotal role. Two other suggestions to enhance sustainable practices included involving local communities and using more diverse activities to reduce floodings such as micro-storage of water on the landscape, continuous sensitization and awareness creation especially the communities in living in the flood areas. Table 8.7. Presents government agency responses in C4.

Table 8.7 Government Agency Responses C4

Summary of Responses	Frequency
Mitigation Planning and implementation	
Early warning, early actions: sensitization and awareness campaigns, training of volunteers to acquire technical know-how on disaster management. Budget allocation for flood mitigation and relief items, situations is managed as they occur.	1
We undertake some drainage construction based on the capacity of the local government but most emergencies are managed as they occur.	1
Strategies include watershed planning and management, integrated water resource management. mitigation actions thru awareness creation, improved weather forecasting and CC adaptation activities	1
Flood mapping, flood risk assessment, watershed management, clearing of drainages, tree planting.	1
Surveyed critically affected areas in the state and compiled reports including financial implications to the Federal Ministry of Environment on Ecological funds for Taraba state.	1
Planning and implementation of FRM i) Establishment of the Taraba State Emergency Management Agency. ii) Regular meetings with stakeholders, e.g. relevant Ministries, Departments and Agencies (MDAs) in the state and the FMWR. iii) Emergency response action e.g. resettlement, relief materials to victims disaster. iv) Implementation of early warning actions e.g. time reservoir releases. V) Awareness creation and stoppages of activities that could cause flooding.	1
Ideally, the Ministry should be involved in the planning stages. But this is not the case.	1
Not within the scope of the agency mandates	1

8.4. Summary from Interview 1

Findings revealed that the agencies listed above responded well in the aspect of the evacuation of displaced victims to refugee camps and helped in the provision of relief materials during the floods of 2005, 2008, 2009 and 2012.

Regarding organisational structure, the research identified SEMA as the coordinating agency structured into six departments, namely: Planning Research and Forecasting; Administration and Supplies; Relief and Rehabilitation; Search and Rescue; Training; Finance and Accounts. The structure revealed small efforts are made to include public participation in flood hazard reduction, although there was an acknowledgement of the need for community-driven participation with government support; the need for the incorporation of disaster risk reduction into development efforts; and also the integration of scientific study with traditional systems. It was also observed that there was weak coordination among the various levels of the flood risk management agencies right from the federal (FEMA), state (SEMA) levels and the different other stakeholders. The responses revealed an overconcentration of authority on SEMA (without the appropriate financial and legislative support); the presence of awkward bureaucratic processes and administrative bottlenecks which tend to hamper the effective response to emergency situations and public participation. Management response to floods was typically an ad hoc approach. Table 8.8 gives a summary of government values related to the flood management situation in Taraba state.

Table: 8.8 Government Institutional Values Related to Flood Management

Government Institutional Characteristics/ Values in current decision-making	Consistent with Vulnerability reduction approaches? Yes (Y) No (N) In part (I)	Vulnerability Perspective
Narrow view/ limited objectives	N	• Negates the complexity of creation of flood vulnerability and the need for multiple approaches. • Fragmented flood management agencies.
Structural solutions dominate	I	• The dominance of technical solutions negates social causes of vulnerability. • Does address physical vulnerability
Limited public participation processes	N	• Limits use of local knowledge in planning. • Limits political commitments to vulnerability reduction. • Reduces local awareness of vulnerability issues.
Inertia/ inflexibility	N	• Failure of dominant institution to adapt to change is a contributor to vulnerability • Limits their ability to provide effective leadership
Top down decision – making	N	• Government actions are defended by reference to mandate narrowly interpreted. • Local communities are excluded from many decisions with local impact, undermining vulnerability reduction efforts.
Provision of financial compensation to flooded residents	I	• Helps to balance inequities among stakeholders. • Discourages resident from taking responsibility for own actions (encourages government dependency)

8.5 Interview 2 (Local Community Leaders) (CL)

Interviews with 32 local community heads in three LGA conducted (7 in Lau; 6 in Ardo kola and 29 in Jalingo). Information sort includes community flooding history; vulnerability and environmental awareness; local adaptation strategies and participation in flood mitigation (See Appendix B). Responses were also coded into a framework under four categories for easy of evaluation namely Flood history (D1); socio-economic implications (D2); Adaptation Strategies and human management (D3) and community involvement in vulnerability reduction (D4). To address the objectives in section 1.3, the questionnaire was designed to:

- Access the level of environmental cognizance.
- Examine existing mitigative and adaptive strategies at various levels, the current level of vulnerability, risk impacts and resilience practices using flexible approaches to "flood management".
- Understand how the social value of the Directorate schemes is interpreted by the local community.

Table 8.9 presents response categories from the community leader interviews and Table 8.10 shows interview questions and categories for Community Leaders (CL).

Table: 8.9 Response Categories 2

Coding framework	Categories
1. Flood history, Community vulnerability & Environmental awareness D1	• Residential status • Occupation and knowledge of land use • Perception of flood occurrence • Perception of severity • Understanding of the causes of flooding
2. Socio - Economic Impacts D2	• Monetary implications for community • Concerns and Socio-economic impacts
3. Mitigation Strategies and human management D3	• Local flood management strategies • Government flood intervention strategies
4. Community Involvement in vulnerability reduction D4	• Local participation in flood mitigation • Level of involvement in management planning

Table: 8.10 Interview questions and categories for Community Leaders (CL).

CATEGORY	QUESTIONS
Flood history, Community vulnerability & Environmental awareness D1	**Q1.** How long have you lived/worked in the area (study area) and what are predominant land use type and activities. **Q2.** How many flooding events have you experienced in your time here? Moreover, are you aware of your communities' vulnerability? **Q5**. What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?
Socio- Economic impacts D2	**Q3.** Which event were the most severe and how were you affected? In your opinion, is the trend increasing or decreasing? **Q4.** What were the extent of damages and monetary implications for the community? **Q10**.What are your concerns about the socio-economic effects of flooding in the area?
Adaptation strategies and human management D3	**Q6.** Have there been any local indigenous efforts to discuss/implement mitigative interventions? **Q7.** Was there any government initiative for flood mitigation in your local area? **Q11.** In your opinion, what flood management techniques could by applied for flood mitigation in your local area?
Community involvement in vulnerability reduction D4	**Q8.** If yes, to what extent have local officials, and agencies engaged you or members of your community in any issues related to flood protection in your area? **Q9.** Was the local community involved in any stage of consultation and planning? **Q12**.How do you feel you can bring about the desired change in your area as far as flood protection is concerned? **Q13.** How would you like to be involved in the flood mitigation decision-making process? If so, to what extent?

8.5.1 Flood History, Community Vulnerability & Environmental Awareness D1

The rural areas of the case study are uniquely vulnerable to a variety of hazards given their social and economic composition. Economic reliance on agriculture and natural resource extraction in these communities increase their susceptibility to a higher degree. To understand community resilience in a rural context, a brief consideration of recent flood experiences was made. Those experiences and local interpretations of them have permitted existing values currently propagated. Since the reduction of flood risk requires an understanding of the nature of the floods in the context of adaptive capacity and vulnerability, a set of the question asked community leaders their perception of how vulnerable Basin communities were and what variables they see as influencing community vulnerability.

To establish cognizance with community activities and livelihood, each respondent indicated the length of years spent in the area, land use and occupation. 29 out of 32 were born in the community area, and the ages range from 45 - 80. The main occupation was farming and fishing (dry season farming from the months of November – April; all year round fishing) and animal husbandry. Main crops produced are rice, maize, guinea corn and cassava.

Eighty percent of the participants stated that the catchment was more vulnerable to the 2005 floods. Moreover, it was reflective in the erosion rates and losses in agricultural land. There were also concerns about reliability issues in assessing future vulnerability in the long term. On an average, the communities have experienced four (4) flooding events in the last 15 years

(2005, 2008, 2009, and 2012). When asked which event was the most severe and how they were affected, 80% indicated the year 2012, where 95% of the yearly harvest was lost, and 12 deaths were recorded. Responses show 70% of agricultural produce was lost in 2005, 30% in 2008 and about 25% in 2009 respectively.

When asked about their understanding of the causes of flooding and what anthropogenic factors could be contributing to its severity: 20% stated poor drainage system; 35% said excess rainfall; 16% deforestation and change in agricultural practices; 13% release of water from the Lagdo Dam; 9% building on reclaimed flood plains and 7% said it was purely an act of God.

When asked about their current indigenous efforts applied during floods, responses include efforts to reroute flood water from communities' areas; allowing farm certain areas to flood (retention basins); relocation to higher ground during the raining seasons; evacuation by community volunteers. A general concern revealed that the indigenous coping mechanisms employed by the community have become less effective as increasingly fragile livelihood systems struggle to withstand increasing disaster shocks. Strategies to reduce vulnerability should be rooted in vulnerability analysis and greater understanding of both household-level and macro-response options that are available to decrease the exposure to climate risk for vulnerable communities.

On government support, Lau respondents noted very minimal physical intervention but acknowledge efforts towards provision of relief materials, sensitization and environmental awareness on vulnerability. Ardo kola communities also received relief supplies, but by far the Jalingo benefited more

by structural interventions (fortification of the river bank, bridge construction and new drainage systems). The government also offered to relocate some communities in Jalingo, but this was met with stiff opposition (CL, 4, 5, 6, and 7). Table 8.11 presents a summary of community responses in D1.

Table: 8.11 Community Responses on D1

Summary of Responses	**Frequency**
Established stay in Community 29 Born in the community Average age range 45-80 years **Main Occupation** agriculture, fishing and animal husbandry Pretty trading Civil servants	 25 5 2
Flooding History (1999-2014) 4 flooding events (2005, 2008,2009,2012) 3 flooding events (2005, 2009,2012) **Vulnerability Awareness** 26 out of 32 aware of community vulnerability	 29 3 26
Environmental awareness Excess rainfall and deforestation The act of God. Deforestation and anthropogenic factors Increased rainfall and change in agricultural practices Change in agricultural practices and deforestation The release of flood waters from the dam in Cameroon. Change in agricultural activities, loss of vegetation cover. Indiscriminate building and bad drainages Bad building plans to obstruct flow pathways	 16 2 14 12 10 17 12 10 15

8.5.2 Socio - Economic Impacts D2

The approach was aimed at reflecting the self-reliance of people in hazard-prone geographic areas and their ability to use resources and organisation to withstand the worst effects of natural disasters. Values related to growth and economic development was apparent in all three communities' interviews. Discussions from the participants suggest that the value placed on development comes in part from the assumption that development is the best means of ensuring the economic viability of the communities. For example, the 2005 floods brought alongside 95% loss from crop yields and an abundance of fish harvest. Similar damages were experienced in 2012 with records of 12 deaths. As agrarian communities, the respondents were concerned about the impact of these floods on the local economy; an extension of this concern was the negative consequences of these floods on the local economy, rural - urban migration especially the younger population (workforce) which may cause the slow death of traditional ways and wisdom. Communities' discussion also included a consideration of the benefits of flooding. Responses also show flooding events were associated with a higher fish harvest and increase agricultural outputs from previously flooded areas. Table 8.12 presents a summary of community responses in D2.

Table 8.12 Community Responses D2

Summary of Responses	Frequency
Flood severity	
2012	26
2005	6
Trend	
Increasing	17
The same	6
Not sure	7
Only God can say	2
Economic impacts	
95% loss of agricultural produce in 2012, 12 deaths recorded	15
70%loss from crop yield in 2005; an abundance of fish harvest	6
30% losses from produce in 2008	4
25% losses in 2009	19
Affected the live hood of community, many dropped out of school	16
Severe damages to buildings, siltation leading to loss of farmlands	29
Damages to residential building and commercial building (hotel)	
Loss of private houses	4
Loss of farmlands on the flood plains by siltation	18
Loss of roads (Disconnection of some residential areas).	29
	17
Socio-Economic impacts	
Loss of valuable farmland as a result of siltation, loss of live hood.	
Losses of private buildings/farmlands	
Loss of income from halt in business activity	
Emotion distress during floods	
Loss of income Loss of business and live hood	
Disruption of communal activities	

8.5.3. Mitigation Strategies and Human Management D3

Based on their responses to the questions concerning community ability to respond to flooding events (D3), perceptions of what constitutes flood 'mitigation' were varied. Strategies mainly include rerouting floodwaters from residential areas, local community effort towards sediment control, fortification of riverbanks, reforestation and local efforts to relocate communities uphill

avoiding lower levels of the floodplains during events. The majority of respondents from all three both communities showed a distinct preference for structural interventions. Table 8.13 presents a summary of community responses in D3.

Table: 8.13 Community Responses D3

Summary of Responses	**Frequency**
Local adaptive strategies	
Yes, community efforts to create local access to release flood waters.	**13**
Self-help project to protect individual houses.	**18**
Temporary relocation during floods.	**6**
None we just relocate during the floods	**4**
Creation of alternative field upland to ensure the security of flood supplies, local information dissemination on safety measures.	**10**
Local effects to relocate uphill using youth groups, avoiding lower levels of the floodplains	**4**
Discussion on river dredging	**11**
Self-help i.e. Sand bags and clearing of drainages.	**18**
Private effort to reduce erosion	**28**
Fortification of river bank and erosion control using sand bags	**13**
Private efforts at afforestation	**6**
Government Responses	
None	**4**
Very little	**7**
Yes	**16**
No physical intervention, only sensitization on vulnerability.	**4**
News on flood vulnerability on the radio	**16**
Reconstruction of damaged bridge	**16**
Construction of drainages	**8**
The government offered to relocate community.	**4**
Human management	
Improve drainages and retention basins	
Creation of makeshift home during the raining season. Build embankments and raise higher ground to Reforestation, Relocation to higher ground, provision of first aid and relief materials during floods i.e. mosquito nets. To protect the communities.	
Advance information of the release of flood waters/ release during the dry season, improved drainage systems	
Dredging the river to increase storage capacity	
Refrain from floodplain development, change in agricultural practice.	
Afforestation and sediment control	
Erosion control	
Manage natural obstruction in the river channel and dredging	
Rotational cropping	

8.5.4 Community Involvement in Vulnerability Reduction D4

Responses were unanimous that before the 2012 floods, local/ state authorities 2012 did not invite community members or their representatives to forums or meetings concerning flood mitigation. However, there was an acknowledgement of relief materials provided by SEMA after the floods. Suggestions that previously communities played no role in policy formulation and implementation even though institutional guidelines require this. However, there was overall support for community participation. As one respondent from Ardo kola state "…….we have to do this together, they have to listen to us, the impacts are far beyond what we have seen, talking is the only reasonable way forward "……. CL27, 03/02/2014. Lau leaders were unsure about the appropriate improvements that could be done on local scales, (community proximity to the river), reasons were given to be presumed financial implications for them. Some Ardo –Kola responses proposed measures as advance information of the release of flood waters (From the Lagdo dam in Cameroon); assistance for evacuation during floods, dredging the River Lamurude (see fig: 4.11) to increase storage capacity and relocation of community further uphill. Table 8.14 present community responses in D4.

Table: 8.14. Community responses D4

Summary of Responses	Frequency
Community Involvement in Management	
No	4
Yes we were told of the government plans for the construction of the bridge and drainage	18
Solely government intervention	3
Yes some community leaders were consulted	13
Some government initiatives work with community groups to give aid and assistance during flood events	13
Private intervention	5
Community involvement in vulnerability reduction	
Not sure	4
Not sure will rely on govt efforts	2
Don't know	2
Improve information/evacuations during flood events	32
Welcome consultation with govt.	31
Relocation of the community further uphill.	8
Communal efforts to consider mitigative measures	16
Beyond community scope	4
Encourage tree planting	10
Regular clearing of blocked drainages	21
Change in agricultural practice	20
Avoid flood plains	2
Community willingness to be involved	
Yes from the onset	32

8.6 Summary From Questionnaire 2

From the responses (D1), it is evident the communities have an understanding of human – environment interactions and are also aware of linkages between climate vulnerabilities, development and poverty alleviation. Coping as a short – term response to variability is currently practised but at this point, the necessary adaptation is beyond the capacity of the people experiencing the

threat and assistance needed. Future adaptation strategies would need to adopt social perspectives in line with economic considerations in both the short term and long term.

8.7 Discussion

Responsibility for flood risk management in Nigeria is fragmented both within and across administrative boundaries. This has practical and social implications in addressing flood risk and community resilience. The social aspects of environmental management have two distinct components, one that concerns public involvement in managing the decision–making process and one that integrates social considerations into the science of understanding the environment as perceived by the public. This section will attempt to place interpretations elicited into a common scientific frame through the concepts of environmental management.

Responses from both interviews reveal some vital issues that require detailed discussions to meet the objectives of the study. It is evident from the results that the pursuit of sustainable development regarding flood management is yet to be deciphered in practical terms within the study area. Clearly, there is an inextricable link between poverty and environmental degradation. Institutions response procedures were found to be ad-hoc, ineffective and poorly coordinated notwithstanding the plethora of agencies involved i.e. agencies within the three levels of government (see figure 4.4). The failure of current strategies to effectively manage to flood in the study area justifies the need for the adoption of a more efficient and innovative response. Implications for new dimensions for flood mitigation that must address gaps in the current

institutional response approach, consider flood dynamics, local economy, and adaptive capacities of the local environment. In this vein, the study cannot maintain to tackle all the issues at stake comprehensively; however, the discussion (in chapter 8 & 9) will attempt to speak to some salient issues that could address the current deficiencies in the system.

8.7.1 Institution Response To Flood Management

Responses from the Government questionnaires show two agencies have direct mandates for flood management (SEMA & MEUD). MEUD (GA1) is mandated to assess the flooding potential of watersheds as well as to determine, design, develop and authorize the development of appropriate flood mitigation measures in these watersheds With regards to SEMA (GA4), mandates seem to cover post-flood responses with no involvement in pre-disaster preparedness i.e. reply to Question 3: "To create awareness, rescue victims of flood, relocation of casualties, rehabilitation and provision of relief materials……." (GA4, 10/02/2014). However, interestingly SEMA acts as the coordinator of all stakeholders involved in flood management. This is against the background that it also covers a broad range of other environmental disasters. Its responses to Q10 show the agency is under-equipped to handle these responsibilities: "…the challenges are enormous…..insufficient funding …..dearth of personnel, poor cooperation from local authorities (GA4, 10/02/2014). Findings from Community leader responses show improved institutional performance in areas of SEMA's response in the areas of relief and emergency (CL7, 9, 11, 27, 28, 30, 20). GA5 & GA8 also commented on weak coordination between the main agencies and on the need to train more personnel in disaster management. This result is clearly seen in the communities as one noted: "….we only get seen when there

is a big flood……..” (CL28, 03/02/2014). Poor coordination across administrative bodies and line agencies results in fragmented flood mitigation and prevention intervention measures. As a result, flood disaster victims are left alone to fend themselves especially in remote areas due to incomplete implementation, poor follow up, and structural biases. The absence of a monitoring /evaluation system for SEMA’s performance could also be a contributing factor to its underperformance.

As discussed in section 2.3, institutional changes would be needed throughout the levels of management and the design of bespoke institutional design plans which captures structural, agency and learning dimensions of adaptation challenge. This change must support “management as learning approach” in dealing with complexity and practicability of future strategies.

Research on institutions has not yielded many concrete answers to the challenge of how to facilitate necessary institutional change without imposing external blueprints that ignores the intricacies of local conditions (Evans, 2004). Adaptation to climate change impacts represents specific challenges for the institutional dynamics. Successful governance structures for adaptation will depend on enabling and supporting adaptive institutions that can cope with complexity and uncertainty in the face of new challenges (Pahl-Wostl, 2002; Huntjens *et al*., 2011 and Pahl- Wostl, 2009). Results from research have indicated that a major factor responsible for the poor flood management responses is the governance structures and specifically the institutional design schemes and how its support adaptation process at different levels. There is the need also to assess the capacity of institutions to adapt to climate change and

the way in which institutional arrangements might enhance this capability. Also, need to identify and evaluate the ability of theses institutional arrangement in diverse settings, since adaptation must be fine-tuned not only to the specific features of local conditions and ecology but also to local economies and cultures (Huntjens *et al*., 2012).

8.7.2 Community Involvement In Vulnerability Reduction

The incoherent institutional responses reflected in the strategies of participation at the community levels. For instance, the question on community engagement had the following responses:

……..On the above-mentioned planning process, the team asked the communities on their plight and their needs that the government can assist in their vulnerable conditions (GA1); GA2 & GA3 responded as no engagement with community ; GA4 "Yes, especially in the area of camp management in identifying suitable locations and decisions that borders the internally displaced persons"; GA5 as " At all times vulnerable communities are involved in the planning process" GA6 "The vulnerable communities participated in the planning and implementation process". GA7 "Ideas are being sorted in some cases, but it is not a formal process"; GA8 "Not formally but plans are under way to involve the communities thru the community associations and clubs". None of the agencies provided a clear strategy on communities' participation. These suggest an absolute top- down approach of governance which tends to prioritise and solely appreciate professional and scientific "expert" knowledge; as a result of the approach potentially excludes and alienates the local people and their internal resource management schemes. Similar limitations of top-

down approaches are observed by Smith, (2008). Adeoti, (2007) support these findings; his paper indicates the absence of legal provisions for river–based participatory approaches and stakeholder management platforms within government and non- governmental bodies. While most of the community leaders indicated their willingness to participate, most of them were not sure on how to do so. I.e. " I am not certain how we can help, but yes if the government decides to, we as a community are willing" (CL12, 6/01/2014); "Yes at any stage. We will be happy to be involved (CL2, 30/12/2013);... Yes, we will be glad to be involved, why not we are the people who live here (CL1, 30/12/2013). These responses show the communities are not aware of their right and place within the confines of engagement for management.

Experience from both development and disaster management processes highlights the importance community participation in flood management as discussed in section 2.2.4. Community involvement is necessary for any pre-disaster mitigation or preparedness: as potential victims, first responders, carriers of traditional coping mechanisms and the users of post-disaster actions. However, there are several constraints to effective community participation in disaster risk reduction as elucidated for the interviews.

a. Low Environmental Awareness and Inadequate Dissemination of Vulnerability Reduction Message

Lessons from the past flood disasters (2005, 2008, 2009, 2012) have not been sufficiently disseminated to the communities, and they, unfortunately, continue to be confirmed within government archives and academic circles despite the fact that the studies and research have provided insightful recommendations for

practical applications in vulnerability reduction (see Appendix F). Thus far, the possibilities for efficient management of science and technology have not reached community levels. Local knowledge is often put to good use, but future strategies will require the implementation of an effective awareness program with the sole purpose of enlightening the communities on their roles in management at grass root levels. This scientific understanding needs to be adopted alongside local knowledge.

b. Existing Coping Mechanisms May Be Inadequate, but should be a Starting Point

Communities have been able to use traditional wisdom and local coping mechanisms to deal with the disaster, and these should be exploited. Responses from question 6 show some communities have inherited coping mechanisms such as re-routing flood waters to certain flood farmlands (and using such farmlands for dry season farming); community efforts to fortifying river banks and relocation to higher ground during floods among others (CL27,03/02/2014; CL24,30/01/2014; CL21,27/01/2014). A low- tech approach is a reasonable starting point to blend technical improvement and local coping strategies.

c. Socio- Economic Factors Render Mitigation as a Low Priority

Within the communities interviewed, the level of acceptable risk is high due to rampant poverty. This precludes effective participation of society's weakest segments, which are also the most vulnerable in disaster risk reduction initiatives. Responses show some communities were sceptical of any form of involvement because of financial implications (CL13, 25, 27, 30, 15, and 29).

8.8 Research Implication for Environmental Policy and Management

8.8.1. Contextualising the Significance of Locally Based Understanding of Flood Management.

Growing vulnerability to floods in Taraba state emphasises the need to pursue research in this field. The complexity and diversity of flooding realities give way for new theoretical perspectives that look for answers in human development and the choices therein. This search also explores the human influence and agency over the environment and highlights the inability of science to address inherent uncertainty in socio–environmental systems (Scoones, 1999). Research investigations and literature review show the management of perennial flooding management in Taraba state found wanting both the areas of policy and research for adaptation. In response to this, the key focus of this research is to explore existing management procedures with a specific focus on opportunities for community participation in developing sustainable management pathways.

Findings from 8.3.2 show community engagement borders around inactive dissemination of environmental information according to Davidson (1998). However, this research proposes the integration of poverty alleviation objectives with flood mitigation to enable and encourage "development –driven" involvement (Okali et al., 1994). The position adopted in this research acknowledges the complexities and challenges associated with participation, but still, uphold it remain a major platform for change and adaptive management. Findings show community associations play important roles in disaster management. If participation is understood as a process based on relationships,

it becomes necessary to establish how these relationships are forged and conceptualised in the light of changes in the way disaster management and subsequently environmental policy.

The geographical location and geomorphology of Taraba state make it is susceptible to flooding. The River Benue traverses six LGAs (See section 4.4). Building structures and other infrastructures in Taraba state were not designed in any particular manner to reflect the risk posed to residents and the general public by flooding. The challenges of population growth and water demands for various human activities requires integrated water resource management in a manner that water services are provided efficiency, adequately, equitably, safely and sustainably. Since the objective of the study was to investigate the legal and policy requirements likely to support sustainable flood management schemes in the context of climate change, stakeholder engagement, rural land use and localism agenda. The outcomes are anticipated to serve as guides to researchers and policy makers.

In the light of recent flooding events, the agricultural sector in Taraba state is now coming to terms with the adverse consequence on livelihoods, decline in crop yields and productivity of livestock. The challenges militating against the effective flood management in Taraba is significant as the system still adheres to the traditional fragmented approach.

8.8.2 Stakeholder Engagement and NFM Feasibility

Modern conceptualisation of FRM personifies active engagement of citizens in the appraisal of risk and development of risk-reduction options flood risk, both of which are lacking in the case study area. Citizen participation during policy

and planning ranges from compliance to full collaboration (Carina and Keskitalo, 2013). While stakeholder involvement could be accomplished within multi-sectorial, cross-border and multilevel groups, in any case, collaboration with respect to future change requires particularly structured and more permanent networks where a systematic governance focuses on the creation of enabling environment, such as the overall policy, economic, regulatory, and accountability frameworks within which organizations and individuals operate . Responses from the community leaders indicate limited public participation despite the number of agencies with mandates for flood management. (see Figure:3.4) However in line with the Adeoti, (2007) conditions do exist for the implementation of a participatory approach which ranges from a political willingness to socio-economic, environmental and sustainability issues as evidence from Section 8.5.4. Show community willingness to participate.

8.9. Summary

Flood management practices were examined to identify current issues and explore the feasible of a more flexible flood risk management system, based on the emerging trends in biophysical and social drivers across the study area. Presently flood administration and basin-wide resource management decisions in Nigeria assume a top –down approach with the government as the only responsible body through some agencies. Despite national aspirations to reform its policies in support of economic growth, sustainable development and poverty eradication, there is still much to be desired regarding coordination and compliance. The absence of legal instruments enabling participation in environmental management and fragmented approach to flood management

has resulted in years of neglect, increased the vulnerability of communities and worsening environmental degradation.

Understanding the socio-economic and ecological implications of flood mitigation in rural areas will require the active participation of the range of stakeholders. Reliability issues have created growing interest in resilience and adaptation. From the responses, the communities within the study area have witnessed many floods and have adapted to some extent to the prevailing conditions. These adaptive approaches could be leveraged on in conjunction with government responses to mitigate the adverse impacts of flooding within the communities. An underutilised contribution is from the academia, several research outputs from flood studies carried out by the state University remains in the confines of the institution, and no synergies exist between the academia and the flood management process. The research also identifies several challenges local authorities face in this context with regards to effective management, these include policy gaps, the absence of legal stakeholder management organisations at basin and sub – basin levels, weak sector collaboration and low level of disaster awareness and education.

The role of institutions and particularly those with decision –making power is essential to vulnerability reduction of both physical source and social sources of vulnerability. Although the Nigerian governments have formulated regulations and management structures to cope with flooding, the lack of inclusion of the local conditions and vulnerabilities act as impediments to their achievement. This indicates the need to include local knowledge and skills from specific communities in disaster prevention activities. It is evident from this research

that the changing of values and beliefs within society would require a markedly different or expanded approach to flood issues within mandated institutions, the development of a much-enhanced skill set concerning community outreach and liaison, and better communication strategies. The idea of grassroots approaches to vulnerability would require local leadership to take the initiative concerning assessing and ameliorating vulnerability, formal recognition and assistance to pre-existing local groups by decision-makers where possible, and development of new community-based groups armed with appropriate resources (practical and technical) to address flood resilience concerns. This way, a bottom –up flood management for resiliency may become a future recipe for FRM in developing countries where the role of government in flood management is still minimal.

CHAPTER 9

9. MOVING BEYOND CONTEXTUAL EVIDENCE: ANALYSIS OF RISK MANAGEMENT AND IMPLICATIONS FOR NIGERIA

9.1 Introduction

This final chapter of analysis offers a distinctive approach to addressing the empirical material gathered throughout the research. The theoretical underpinnings of the analysis produced in chapter 6 were based on the social constructivist; in that, they are focused on determining the social dimensions of NFM applications in the UK, has been largely driven by legislative drivers. The multiple case approaches gave rise to an appreciation of NFM application at local scales. This chapter is a synthesis of this study's research findings. It is an examination of the inter-relationship between NFM, stakeholder engagement, community adaptation towards resilience building. Key findings revolve around significant engagement gaps relating to current approaches: the ambiguity of "community engagement" and what is meant in practice; holistic management of floods and other associated environmental impacts (eco-system approach); and how to structure and integrate adaptation planning in the context of many other developmental objectives.

The themes present in Chapter 7 are central to the adoption of NFM within the SFM approach. Management responses differ; however, most case studies share one fundamental characteristic: community partnership platforms have the potential to enhance acceptability and collaboration for NFM applications. In drawing meaning and understanding from the various NFM applications, the viewpoint adopted in the previous chapter depicts some important dimensions

at play in the issue of participation for NFM es are yet to be experienced and studied empirically.

9.2. In the Pursuit of Sustainable Development (SD)

Sneddon e*t al.* (2006) argue that the concept and practice of Sustainable Development (SD) which guides institutional principles (tangible policy goals, and focus of political struggle) remain salient in confronting the multiple challenges of the new global order. In their view, the significant way to address the dynamism and complexity of the current era of global environmental governance is to adopt pluralistic and transdisciplinary approaches. However, the conceptualization and interpretation of SD depend on the willingness of practitioners to embrace a range of epistemological and normative perspectives on sustainability. Furthermore, its understanding is associated with the evolving concept of development and politics of sustainability itself (Geels. *et al.*, 2015).

As discussed in section 4.2, our understanding of current systems and predictive capacity of the future is limited by uncertainty (Knutti. *et al.,* 2010; IPCC, 2012; Knutti and Sedláček, 2013), so new approaches to SD must consider the interactions between climates, social and ecological systems.

In developed countries, sustainability deliberations centre on environmental topics, while in developing countries the issues of poverty and equity are equally important. Consequently, SD in developing countries must consider poverty reduction through a multi-scales perspective that takes into account socioeconomic, cultural, biophysical, and institutional contexts into account. Leemans and Soecki (2013) redefine the Science of environmental sustainability by proposing a deeper engagement with human-environment interactions; the

'management' of global change; and the dynamics of governance and human behaviour. This definition associates sustainability governance with transformational changes, reflecting the diverse and pervasive approaches to governing sustainability problems and catalysing change.

On flood management, Section 2.5, presents EU current pathways in tackling SD complexities. A part of which includes the establishment of public participation mechanisms to ensure citizens' involving in flood management. Reed (2008) argues that current trends be progressively moving towards a collaborative learning approach where stakeholder involvement is seen as one of the indicators of sustainable development, embracing a diversity of knowledge and values underpinned by a philosophy of empowerment, equity, trust and learning. The major challenge herein is in the understanding and management of growing complexity of socio-economic reality and its immediate relevance for sustainable development. Theoretically, interdisciplinary approaches of natural and social sciences addressing sustainable development and the study of strategic management are rarely related to each other (Stead and Stead, 2000; Reinhard *et al*., 2005). It is argued that the integration of local and scientific knowledge could provide a more comprehensive understanding of complex and dynamic socio-ecological systems and processes (Reed, 2008). As a consequence, there is growing interested in understanding how policies could be designed to be more responsive to environmental and social change (Spray *et al.* 2009).

The social science of sustainability entails learning to facilitate the adoption of sustainable practice through presents ways in which informal learning can

promote. Recent research on public participation like one done by Wehn *et al.*, (2015) proposes citizen observatories as an innovative way to provide citizens with a new role in decision making.

Public participation in flood mitigation design emerges as a powerful tool for more integrated disaster mitigation and urban water management; however, the institutional set up needs to be appropriate. Finding from (section 8.3.3) show government agencies have different perceptions of citizen participation with pertaining to roles and influence. Still building up at local levels a consensus on flood mitigation requires a new behaviour from all stakeholders. These include granting legitimacy and recognition, strong capacity of dialogue and the management of decision-making process. However, there is a paucity of research on the development of facilitation methodology for problem solving amongst multiple stakeholders. (Bonnell, J.E., 2002; Cook and Lane, 2010).

As discussed in section 2,4 community cooperation is seen as key for the support and the promotion of NFM under the current policy climate. Legalistic rationales account for NFM adoption in the UK. Hitherto, on-going aspirations struggle to learn from experience and respond to complex social–ecological conditions reflecting an emerging paradox of learning in adaptive co-management. As seen in the case studies (chapter 4), voluntary and community –based approaches are necessary to meet the challenge of sustainable management at the same time community partnership platforms are seen as important transmission mechanisms that could potentially transmit NFM strategies from policy aspirations to implementation. However multi-actor collaboration is characterised by uncertainty and ambiguity, and it does not lend

itself to be managed in any traditional sense, taking into account the ambiguous and uncertain nature of complex adaptive systems. Furthermore, Bouwer *et al,* (2013) identify potential challenges in dealing with power dynamics and the growing concern of marginalisation of less powerful stakeholders.

The UK case studies offered an opportunity to explore the dynamics of NFM applications. For the UK case studies, there are relatively plentiful resources for an optimal "blend" (technical or land use planning) of methods and governance arrangements to achieve given water management objectives. For communities in developing countries like Nigeria, the scenario is rather different. There are stark choices to be made, further grounded by a dearth of specialist personnel and data. (i.e. leveraging scarce financial and human resources while ensuring compatibility with broader sustainable development objectives) findings in section 8.7.2 show socio-economic factors render mitigation as a low priority. While the feasibility of a sustainable approach considered for the Nigerian case study based on lessons learnt from the UK studies, it is noteworthy to stress the discussions cover different contexts. However, the role of community involvement, aided by non –governmental organisations in catchment management is a theme that runs through all the UK cases studies and the same is considered for the Nigerian case study. The presence of Stakeholder Platforms in some case studies (chapter 7) was seen as having the potential of providing communities with a substantially new role in decision-making. In line with the objectives of the research, the discussion herein explores NFM complexity under sustainable flood management, stakeholder platforms and the feasibility of its application in the Benue Valley of Nigeria.

9.3. Communities as Viable Systems: Adaptation and Sustainability

Throughout history, societies have adjusted to and coped with changes in climate with varying degrees of success. Adaptation is based on the premise that communities can actively build and engaging the capacity to thrive in an environment characterised by change, and that resilience is an important indicator of social sustainability. Social vulnerability to floods exacerbates social and economic challenges; particularly for societies dependent on resources sensitive to climate change. The likely hood of further changes occurring give an urgency to addressing agricultural adaptation more coherently.

The strong trends in climate change impacts are evident in the Benue Valley, threats are apparent in agriculture, fisheries and many other components that constitute the livelihood of rural populations (Section 3.4). The primary challenge here is in the promotion of adaptive capacity in the context of competing for sustainable development objectives.

In the context of floods, community members are the first responders immediately after a disaster and engagement for mitigation could highlight legitimate needs and difficulties, and proffer ways to address them through self-reliance and mass mobilisation. Devastating floods in the Derwent and Belford catchment triggered such responses for mitigation in the UK case studies. While stakeholder meetings were held immediately after the floods of 2005, 2008, 2009 and 2012 in the Benue Valley, a coalition that was non-existent before 2005.

The dual need for economic development and sustainability make effective program development and implementation in developing countries a particular challenge. In tandem with most developing countries, Nigerian environmental laws regarding sustainability are not implemented appropriately, so there is a need for a new approach on how to achieve the goals of sustainability by ensuring that local community development is sustainable. Given the size of the challenge, sustainable development can only be addressed through a holistic approach where governments, NGOs, indigenous people and the private sector work together. However, the research advocates for community development initiatives with structural and non- structural measures for building community coping capacity towards climate change adaptation.

9.4. NFM Complexity and Sustainable Flood Management

Given the extensive portfolio of potential NFM mitigation measures, identifying the best-performing intervention, effective spatial location and appropriate long-term strategy are challenging. This raises questions about how to achieve this goal and successfully translate the directive into meaningful and effective participation. In essence, this means the scientific evidence base of NFM development is still unclear (Holstead and Wilkinson, 2013).

Howgate and Keyon (2008) research on community cooperation for NFM is also reflective of this uncertainty. Other research suggestions indicate a broader spectrum of the scientific, institutional, economic, social and cultural aspects as part of the complexities and challenges to implementation (Spray *et al.*, 2009; Holstead *et al.*, 2012). Since NFM application is linked to land use, economic factors (i.e. economies of scale, financial incentives, market) all come to play in

practicabilities. Other factors include farm characteristics (size, location, ownership, availability of unproductive land, business structure); social factors (community dynamics, personal interest) and availability of information about NFM. Farmlands as businesses face a complex policy landscape and have to adhere to numerous amounts of legislation, regulation and guidelines related to water management. As a result, the dynamics NFM will need to be paired up against economic viability to make it feasible. Other factors may border around ideas and practices common to the social environment. Donaghy (2010) interviews with farmers found the SRDP funding inappropriate because of the poor level of incentives it offers, the complexity of paperwork, time and associated costs. Several other factors influenced the NFM applications in the case studies. NFM needs to be promoted within the viability of farm lands as a business since there is no direct funding for NFM applications.

Despite the ambiguity, support for NFM is growing at the local, national and international levels. The argument here lies in the acknowledgement that adaptive and flexible flood risk strategies are required to account for future uncertainties. More pilot studies will contribute to a better understanding of the science- policy interface of NFM knowledge.

Findings from research (see section 7.6.4) show elements of social learning through partnership platforms in seven catchments where common catchment issues were addressed within a group of actors; mutual dependencies and interactions are recognised. This understanding of social learning is rooted in the interpretative aspects of the social science similar to the approach adopted by the Harmoni COP project (Kranz *et al.* 2006) To better understand the

process by which catchment stakeholders were able to influence NFM applications, a discussion on stakeholder influence is made.

9.5. Viability of Flood Reduction and Mitigation: The Influence of Stakeholders

Literature in Section 4.4.1 shows that different people perceive stakeholder involvement / participation in the decision-making process differently, and this is dependent on the objectives sought. Pragmatic benefits are claimed for participation, as discussed in section 2.6, very different techniques offer varying levels of stakeholder involvement. Richards *et al.,* (2004) argue that levels of engagement be dependent on the objectives of the work to be done and on the capacity for the stakeholders to influence outcomes. Some approaches may simply convey information to a receptive stakeholder audience such as found in Taraba, UBV, Nigeria, while another could significantly empower stakeholder within the decision- making process. While policies come from governments and often imply some regulatory force, the catchment managers apply management systems more or less voluntarily; stakeholder influences come into play.

The UK case studies show the success of the engagement process depended on multiple factors unique to local exigencies. Individuals and various groups within the case studies construct the implications of this multi- cultural science understanding of realities. Pre-emptive factors influenced management in Spey, Eddleston, Allan, and Upper Clyde; while remedial factors played out in Belford, Tarland and Derwent. This has important implications for the impetus behind stakeholder management, for developing the framework responsive to the catchment issues and providing equitable opportunities for participation. Within

this discourse, it could be argued that closeness of communities to their environmental problems enabled them to have a great say in ecosystem management as solutions emerged from a local process of dialogue and debate.

Stakeholders can assess the viability of adaptive measures by integrating scientific information into their social, economic, cultural and environmental context as the process is seen as a meaningful part of formulating and implementing sound policy. Pragmatic claims lie in the premise that it could lead to better and more responsive services; tackle people's disengagement from politics and the democratic process; build social capital and create opportunities for balancing conflicting economic, social and environmental pressures. Engagement is never easy. It takes time and critics say it could create ambiguities and delay decisive actions, considering the multi-sectorial, cross –border and multilevel stakeholders involved in resource management (Bojorquez-Tapia *et al.*, 2004). While stakeholder participation is appropriate, collaboration on future change requires particularly structured and more permanent networks.

Since the social dynamics of adaptive capacity is defined by the ability to act collectively, a variety of different specific benefits flows from the trust, reciprocity, information and cooperation associated with social networks. Findings in (Section 7.6) research, suggest these networks helped the communities to develop the capacity and trust needed to collaborate with a broad range of formal and informal relationships ranging from formal legal structures and contracts to informal, voluntary agreements.

In this view, social capital holds out the possibility of improving social outcome more efficiently through legitimate and cheaper public service delivery where participants build relationships with government institutions, which could open channels for communities to access valuable external resources, support and advantage. A critical question is "Do policies to promote community participation in governance builds social capital?" Since actions and decisions of individual actors are influenced by their relationships with others and positions with the social structure, social capital alters the power relationships between civil society and the state (Bebbington and Perreault, 1999). The key issues are whether social capital exists only outside the state and whether social capital is a cause or merely a symptom of a progressive society. Access to linking social capital is shaped by a range of background factors that affect levels of participation, including socio-economic factors. This is probably to be embodied in the main relations between organisations. The findings suggest the most diverse group of stakeholders involved in management, the better opportunities for participation. For example the Tarland catchment Initiative: a partnership project between researchers, regulator, local community, was at the heart of research with the James Hutton Institute; The Eddleston: a partnership of local and national organisations; Spey catchment initiative: local and national organisations; Belford: - association with the Northumbria Regional Flood Defence Committee, North East local levy and Newcastle University; Derwent-Woodland Trust working in partnerships with landowners; Allan Water-steering group with representative of multiple agencies .

Regarding NFM, regulatory frameworks for mitigation need to resonate with social norms and local exigencies. Findings in section 7.6. Support these views.

Social capital is seen here as the critical pathway for adaptive capacity, particularly in response to uncertainty and unexpected precarious events, but the prevalence of different types of social capital is imperative at various times to the different social groups. The social constructivist viewpoint adopted for this research acknowledges the different models and approaches that have been used across a range of issues, time and spatial scales; lessons from the engagement process and challenges and opportunities. Focusing on communicative and collaborative procedures allows for a closer examination how NFM applications are constructed discursively, how the stakeholders influenced the process.

Reed (2008) reasserts flood management has over the years become necessarily more complex, with responsibilities split between local, national bodies. The fusion of environmental management and stakeholders creates a systemic and multidisciplinary integration that serves to model catchment strategies toward developing sustainable development and forming strategic alliances. During the research, it became perceptible that the parties concerned, through a process of interdependent networks, positively influence the NFM interventions applied in the case catchments. The research findings could argue success exemplifies the heterogeneous character of sustainability and its practical utilisation in NFM applications.

9.6. Rethinking Sustainable Flood Management: A Framework for NFM Contributions through Community Partnerships Platforms (CPP).

While sustainable food management is promoted as a desirable goal within a variety of policy context, critical questions concerning the extent to which communities and governments can address the challenges of sustainability remain unanswered. Many analyses of sustainability impacts ignore the ways in which economic, social and political processes across different levels and systems of governance interact (Gibbs & Jonas, 2000; Gleeson & Low, 2000; Bulkeley & Betsill, 2005). In flood management, there is a gradual realisation concerning planning that the data used to manage to flood may not be as accurate as initially thought. Conceivably, even more, upsetting for flood managers is that the whole approach to probabilistic flood mapping and assessment does not capture the sheer dynamism of changing precipitation regimes, urban water cycles and additional development. (Scott *et al.* 2013).

In exploring the politics of implementing NFM, the research finds that the interpretation and implementation of NFM in the case studies were shaped by the forms of governance that stretch across geographical scales, involving relations between levels of the state and new network spheres. The case studies illustrate how these partnerships were being conducted both through relations between nested tiers of governance and through some "trustees", including multi-scalar alliances of state and non-state actors. How these catchments functioned distills some main influential ideas, approaches in the realm of participatory communication and community participation. As it stands,

NFM could be encouraged through social networks, decisive communication to local stakeholders and a clear communication strategy unique to local exigencies. Constructivist reasoning contributes to this effort by emphasising processes of social action, its potential to provide frameworks for research in multicultural science education and in developing innovative strategies for environmental management.

9.7. Envisioning NFM Strategies in Taraba State

9.7.1. Introduction

The UN General Assembly Resolution on Sustainable Development call for the integration of disaster risk reduction and resilience building into policies, plans, programmes at all levels and consideration within the appropriate future framework in the context of sustainable development and poverty eradication (UN, 2014). The social impacts of disasters expose inequities and keep the poorest poor. UNPD reports reveal low-income and lower-middle-income countries have accounted for only 33%of disasters, but 81% of all deaths. Poverty and environmental degradation are interwoven suggesting sustainable development require an understanding of the current issues from many angles, not just from an environmental or economics standpoint.

The absence of holistic thinking at administrative and managerial levels reflects in the perceptions and management of floods in Nigeria. This has implications for adaptation in the theoretical conceptualization of vulnerability and resilience planning. Although formal environmental regimes have developed considerably from humble beginnings to the promulgation of twenty-four environmental regulations (FRN, 2009) with four broad environmental issues being accorded

highest priority: safeguarding sustainable industrial production; preventing and reversing desertification; managing the forest, wildlife and natural resources; combating floods and erosion (Ladan, 2012). Despite these regulations, there is still much to be desired regarding enforcement and compliance. Conversely, effective implementation of these regulations will require the significant capacity building of the respective agencies regarding human, technical, material and financial capability; and also effective collaboration and cooperation of various stakeholders within the three tiers of government (local, state and federal).

Flood management strategies in Taraba state do not incorporate flood mitigation agenda within its developmental plan. The current system for participation is disjointed and ineffective (see section 4.5.4). Responses to flood events have mainly been on ad-hoc basis focused primarily on recovery and alleviating immediate and short – term needs such as the rebuilding of destroyed assets, with minimal efforts on creating adaptive capacity. Findings on inter-agency collaboration in Section 8.3.3 show a dominant top to bottom approach, a one-way communication process that is ill-equipped to account for the levels of complexity involved in flood mitigation. In particular, policy and programmes management structures lack an adequate institutional system for applying cost efficient and reliable technologies for disaster prevention, early warnings, and mitigation. As a consequence impacts are not translated because of legislative and administrative inadequacies. This is significant as disaster risk reduction is an important pillar for sustainable development.

The conceptual framework for this research constructs community vulnerability to include a consideration of social, immaterial and spatial elements. Thus vulnerability of communities in risk-prone areas in Taraba must be looked at holistically in enhancing local capacities. For this to happen, the approach must be pluralistic that gives space to each management style with varying obligations of varying scales. As adaptive capacity is intimately connected to social and economic development, economic losses and impacts have remained high and constitute a significant developmental burden. This necessitates the need for new types of strategies aimed at strengthening local capacity to cope with flooding and plan adaptation measures. Disaster–related development interventions need to identify the coping capacities already existing in the communities as potential pathways to adaptation (Anderson and Woodrow, 1998). Research findings section: 8.5.3 show communities have adopted several indigenous measures. However, these isolated interventions could be revisited with sustainability models through the whole catchment approach to improving overall impacts for flood mitigation. Future frameworks would also have to address agency coordination for flood mitigation.

Results from Chapter 7, present six themes that informed understanding of NFM applications. Consideration of these is made for the Nigeria scenario. This part of the research considers the feasibility of an NFM approach for flood mitigation in the case study catchment. It investigates the legal and policy requirement that are likely to support the NFM approach. A consideration of these factors is made in the context of climate change adaptation, stakeholder engagement, multiple benefits, rural land use, trade-off mechanism and localism agenda.

9.7.2 Legislative And Policy Drivers

As with many aspects of social policy, political commitment to environmental issues is cardinal to improving current situations. In line with the Kyoto Protocol agreement, Nigeria submitted its First National Communication (FNC) in 2003 to the United Nations Framework Convention on Climate change (UNFCC) (FGN, 2003). Since then, it has made progress in identifying and prioritising adaptation strategies sectors of the economy. Also, it has prepared an NASPA-CCN. According to Nigeria, "NASPA-CCN seeks to minimise risks, improve local and national adaptive capacity and resilience to (or "intending to") reducing Nigeria's vulnerability to adverse impacts of climate change." (NASPA-CCN, 2011). The National Environmental Policy aims to achieve sustainable development through the following policy initiatives:

a) Preventive activities directed at the social, economic and political origins of the environmental problem

b) Abatement, remedial and restorative directed at the specific concerns identified

c) Design and application of broad strategies for sustainable environmental protection and management at systemic or sub-systemic levels

d) Enactment of necessary instruments intended to strengthen the activities and strategies recommended by the National Policy

e) Establishment, emplacement of management organs, instructions and structure designed to achieve the policy objectives (Ladan, 2012).

Others include the National Emergency Management Agency (Establishment) Act which deals with natural disaster without any special provision to tackle the menace of flooding. The agency duties relevant to flood management include:

(a) To educate and inform the public on disaster prevention and control measures

(b) Distribute emergency relief materials to victims of natural or other disaster and assist in the rehabilitation of the victims where necessary.

(c) Liaise with the United Nations Disaster Reduction Organisation or such other international bodies for the reduction of natural and other disasters.

Moreover, The River Basin Development Authorities Act is another legislation that addresses flood management. The authority's responsibility to flood mitigation is:

"to undertake the comprehensive development of both surface and underground water resources for multipurpose use with particular emphasis on the provision of irrigation infrastructures and the controls of floods and erosion and for watershed management" (FGN, 1999).

9.7.3 Climate Change Adaptation: Multi-Functional Approach

Climate change impacts are one of the biggest challenges because of the communities' dependence on rain-fed agriculture. Other factors include high levels of poverty, low levels of human and physical capital, inequitable land distribution and poor infrastructure. Climate change is already affecting agricultural activities within the case study area. Responses from the community leaders reveal these effects are visible and being felt through extreme weather condition, frequent drought, depleting fish harvest and

agricultural yield, increased biodiversity loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources and soil conditions. (See section 8.5.1).Therefore, the need to adopt water management strategies, weather adapted agriculture, develops a more resilient local economy and rally and coordinate the relevant government agencies.

Within the multifunctional concept, agricultural activities (see section 2.3.7), beyond its role in food production has several other functions to perform such as flood mitigation, landscape and biodiversity management. The application of the concept can be traced to some wider societal and political transformation processes, which have influenced scientific and policy approaches in different ways amongst countries and disciplines (Renting *et al.*, 2009). Current management approach in Taraba is fragmented. It addresses land management, agriculture and flooding on separate platforms with minimal linkages. The idea of IWRM has not been very successful in the Upper Benue River Basin, and this limits the understanding of multifunctional concepts due to inherent constraints of applied conceptualizations and associated disciplinary backgrounds.

The multifunctional character of agriculture has become a current tenant of international discussions of agricultural development (Groenfeldt, 2009). As an important source of employment for about 80% of the communities and the foundation for local economies, the multifunctional feature of agriculture could be central to the larger issue of sustainable social and economic system. Being an agrarian community, the compatibility of agro–environment scheme with

farmers' cultural values can contribute to the sustainability of environmental management. In addition to providing food, agriculture is fundamental to ecosystem services, economic livelihood, social and demographic stability and personal and cultural identity. However, the current demands on food production must be compactable with other objectives for rural landscape. A multifunctional approach to farmland management that integrates food, flood attenuation, reforestation, sediment control with environmental and social objectives, provide the solution if adequately researched and practically grounded. The framework being proposed aims to ensure that this approach continues to evolve.

The theoretical assumptions adopted for this study demonstrate that partnership workings geared at reflecting stakeholder objectives and improving stakeholder's abilities to plan for and bring about the desired change could guarantee the viability of future strategies in a way that connects the principles of ethics and social responsibility. The understanding of individual and community vulnerability is essential for developing strategies for altering the vulnerability of exposed population is most likely to reduce the effect of flooding. The social aspect of flooding has been widely overlooked in flood management in Nigeria. There is the need to for the full integration of technical, local knowledge and socio- cultural dimensions to achieve sustainability. This research proposes a community –based flood mitigation approach that takes in cognizance communities' perceptions and local coping strategies.

9.7.4. Creativity and Innovation

An analysis of the perceived causes of flooding (Section 8.5.1) shows the PVA's residents believe that anthropogenic factors, deforestation and change in agricultural practices have reduced the storage capacity of its natural drainage sinks. Others include violation of building codes, change in water levels, and inefficient drainage facilities are responsible for the flooding problems experienced. This local flood knowledge has implications for a local participatory approach to community adaptations and mitigation methods to reduce flood risks. Indigenous community adaptation choices inform how flood-affected communities cope with floods, especially how they alter their living spaces and respond to emergencies. If these views inform flood adaptation options, proposed mitigative strategies would be more likely to receive local support and acceptance.

9.7.5. Stakeholder Engagement and Collaborative Learning

Stakeholder engagement is challenging, developing countries such as Nigeria are typically saddled with a myriad of problems such as high levels of poverty, inadequate knowledge of adaptation options, weak institutions and other competing developmental goals. While community engagement is now firmly a requirement in the policy agenda, interview responses show the realities on ground differ (see section 8.3.3). Sherman and Ford (2014), made a comparison of institution-oriented, top-down and community –oriented, bottom-up stakeholder approaches in 18 adaptation projects by three of the Global Environment Facility's (GEF) adaptation programmes (SPA; SCCF; NAPA) in developing nations; their findings on the comparison of bottom-up and top-bottom reveal community stakeholder engagement in project design and

implementation led to higher effectiveness, efficiency, equity, flexibility, legitimacy, sustainability and replicability. Their research also cautioned on low institutional capacity constraining both success and efficient performance, with enhanced benefits of external facilitation.

CHAPTER 10

10. CONCLUSION

10.1 Introduction

This research set out to develop a collaborative stakeholder strategy for NFM applications, using UK examples and exploring its potential application within Taraba State, Upper Benue Valley (UBV) Nigeria. To achieve this aim, explicit objectives were set (section 1.5); the objectives were all met and have been discussed in previous chapters.

The thesis research was developed in three phases using a multiple case study methodology (section 6.5). A social constructivist approach was applied in order to illuminate NFM application for flood risk management. This chapter presents a summary of the research questions and proposed NFM strategy; identifies the theoretical implications of the study; highlights the study limitations and finally gives the direction and area for future research.

10.2. Research Questions

UK Case Studies

1. What are legal and institutional complexities and barriers for NFM planning?

The science evidence base of NFM contributions in flood mitigation is still unclear. The evidence surrounding the effectiveness based on modelling exercises is supported by a small number of demonstration projects. Potential outcomes are very site –specific and could be influenced by a range of factors such as land use type geology and topography. Also, a full assessment of all

costs and benefits of NFM applications is rarely available. It is crucial to communicate these uncertainties.

Key barriers to NFM uptake occur within organisational and cultural contexts. In part, this is driven by a weak evidence base and lack of information on the effectiveness of measures. Others barriers lie within appraisal and project implementation i.e. appraisal criteria for flood defence grants and difficulty in understanding the benefits and challenges in monetising eco-benefits associated with NFM application (See section 5.3).

2. How can project consultation be better coordinated to promote the success of NFM projects?

There is a broad range of stakeholders that needs to be included within an NFM communication strategy, managing this would require permanent structures for collaborative management. The effectiveness of inter-agency workings largely depends on the personality and commitment of individuals representing the organisations, as much as on their organisation's commitment to the project. However, the main activities and competencies that facilitated collaborative workings within these catchments include community stewardship, catchment go-between, pre-project engagement and the consideration of multiple benefits. These findings are discussed in Chapter 7.

Nigerian Case Study

3. What policy and institutional frameworks are likely to support an NFM approach in the Benue Valley Nigeria?

Nigeria has many policies geared at general adaptation measures in some climate change vulnerable sectors. These include National, State and International environmental guidelines and regulation. NFM sits within the adaptive confines of NASPA-CCN's national strategy for flood resilience planning in Nigeria (Chapter 4). However, the policy framework is largely underdeveloped. Still, there is the need for a well–formulated grassroots adaptation strategy (Chapter 8). In the absence of an effective national policy for risk reduction and climate change impacts of floods, an alternative grassroots adaptation strategy based on community collaboration for resilience has been developed and is suggested as a logical first step before a national policy is ready for adoption in Nigeria. Other complementing national strategies and objectives include:

- Federal Government Economic Growth Plan
- Nigeria Vision 2020: Economic Transformation Blueprint
- Climate Change Policy and Response Strategy
- National Policy on Environment;
- Nigeria's Agricultural Policy

These national strategies are presented and discussed earlier in the thesis.

10.3. NFM Strategy

10.3.1 Introduction and Context

Flood mitigation and the promotion of viable development are central to the sustainability of flood prone communities in Taraba state. The NFM strategy suggested here aligns with NASPA-CCN (see section 9.7.2) strategic objectives that seek to minimise risks, improve local and national adaptive capacity in

response to climate change impacts and in recognition of the unique needs and vulnerabilities of communities. The NFM strategy contains four underpinning principles; sustainable flood management, climate change adaptation, community participation and resilience planning. It also addresses six priority areas namely: adaptive flood mitigation, community involvement/ collaboration, multi-functional land management, food security and natural water resource. It also tries to convey key environmental sustainability impacts and adaptive approaches available to manage these impacts. In order to deliver policy aspirations, the NFM strategy seeks to provide a coordinated approach to the management of river catchments. It presents a socio-technical platform and sets a broad direction of travel for the future application of NFM, while offering a viable pathway for improving river environments through collaborations and partnerships. The strategy should be adapted to meet the catchment specific needs for different locations. It could also be reviewed and updated as the understanding and scale of the flooding challenge and of NFM opportunity develops.

10.3.2. Strategic Importance

As discussed in (section 3.2; 3.4; 8.8; 9.5) , there is a clear need to improve strategic long and short term flood risk management policies towards mitigation benefits, exploring nature– based options for the protection of natural resources. The NFM strategy aims at supporting a stakeholder approach towards facilitating learning alliances between PVA communities and relevant government agencies for a holistic approach to management of floods and its associated impacts. The NFM strategy is supported by four crosscutting themes;

these include sustainable flood management, multifunctional approaches to flood mitigation, adaptive environmental management and cooperative environmental governance (see section 2.2; 2.5; 2.6.1; 2.6.4; 4.5; 4.5.6). The aim of this strategy is to assess gaps, identify priorities and facilitate the cooperation/collaboration of communities with relevant authorities for flood mitigation within river catchments.

This will be achieved through the development of existing partnerships and the formation of new partnerships, which sets local management objectives and provides the framework for meeting them through a management mix of adaptive and new technologies (see section 8.5.3)

10.3.3 Where are we now?

Taraba has been subject to significant damages from floods and its associated impacts. Current management approaches are remedial with minimal community inputs. Local community adaptation choices guide how flood –prone communities cope and respond to floods, as such a participatory grassroots adaptation strategy for flood risk for resiliency is proposed as a base for action especially for low-income communities where informal settlements are the case and the role of government in flood management is still minimal.

A strategy for future application of NFM approaches is suggested in Figure 10.1 and described in the text in the following sections.

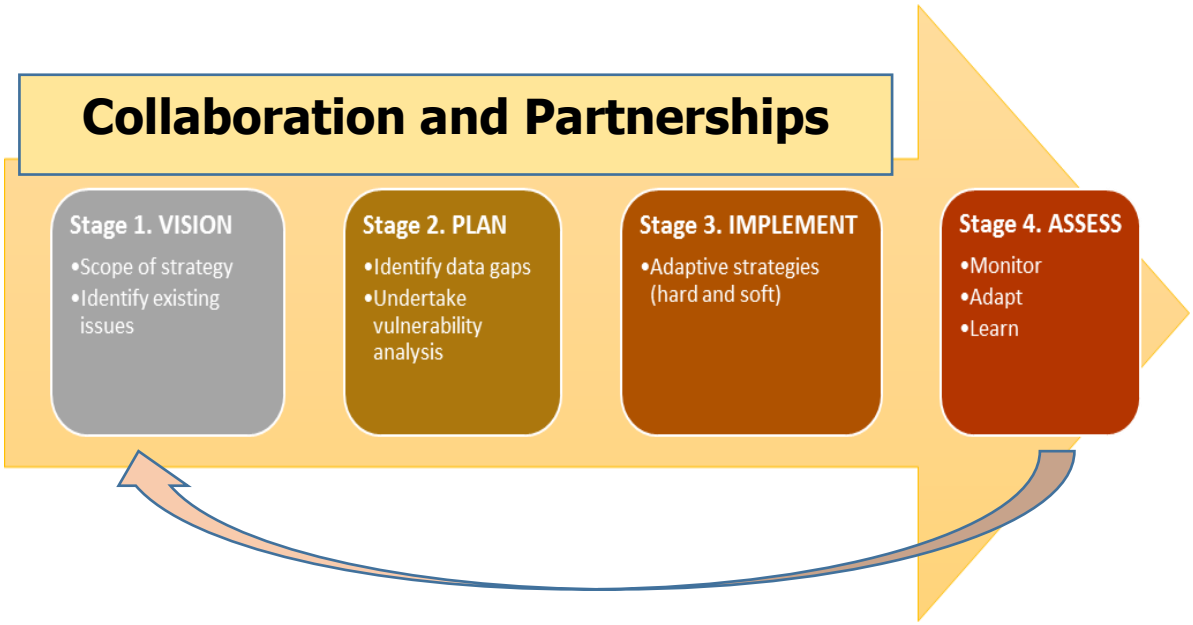

Figure: 10.1 NFM Strategy diagram. A strategy in four clear stages, all undertaken in collaboration and partnership, with a feedback loop to allow an iterative approach to continuing development and improvement of the strategic approach.

NFM Strategy Delivery

Figure 10.1 provides a graphical overview of the suggested NFM strategy. The entire strategy is designed to be undertaken thru collaboration and partnership. A direction of flow for the stages of the strategy is indicated and a feedback arrow from stage 4 to stage 1 reminds users that the processes is continuous and iterative, after a full NFM strategy process is complete it should be started again with lessons learned from the previous cycle feeding into the next. The next sections describe the stages of the strategy, starting with the underpinning requirement for working in collaboration and partnership.

Collaboration and Partnerships

Effective management and recovery from floods can be adequately addressed when agencies work together and community participation is central to this approach. The involved agencies each have their area of expertise (see section 8.3.1). Therefore, agencies must learn to work together to leverage their strengths to the benefit of the community as a whole. At its core interagency collaboration holds the promise of accomplishing jointly that one agency alone cannot accomplish. Findings from section 3.4.2; show a wide range of agencies with minimal community inputs. Within the context of Taraba, inter-agency collaboration with communities is a process which groups come together, establish a formal commitment to work together to achieve common goals and objectives. (See section 8.3.3). Community members have significant roles in establishing sustainable environments. A model for community participation (See section 4.5) is proposed as a starting point to build on the existing local development groups within the communities.

The definition of "community" here refers to the PVA's in the case study area. Objectives were to develop a community-based adaptive flood management strategy and to gain a better understanding of inter-agency collaboration for flood management. Identification of decision–makers and stakeholders was based on their roles in management, system boundary, and decision–making frame.

Interactive models through formal and informal gatherings such as town meetings, community development associations meeting days and weekly market days. Critical success factors for involvement would include: stakeholder engagement; inclusive community participation; participation mechanisms to

ensure citizen's involvement; quality communications and external links to regional planning (catchment approach to management); capital generated through creative collaborations with the three tiers of government, industry and community; champions and advocates (Go-betweens), and efficient and timely project management.

The four stages of the NFM strategy are now described.

Stage 1: Vision

- **Current understanding and scope of management strategy**
- **What are the existing environment issues?**

The "vision" here embodies the social and environmental goals of the community. This stage emphasises defining the problems, identifying the pressures, and acquiring the necessary knowledge to enhance understanding of how the catchment functions. This stage will be critical in identifying cost-effective, sustainable, environmentally and socially acceptable measures. Each community will develop bespoke environmental management approaches to address the prevailing pressures with the catchment.

From the questionnaire responses (see 8.5.1), environmental issues were identified, these included flood mitigation; aquatic eco-systems; irrigation (dry season farming); stock watering; fresh drinking water supplies; deforestation and erosion control and management. The focus will be on identifying stakeholder's broad vision and aspirations for catchment management, settings management objectives and identifying the environmental issues. It allows for considerations to be made for time-periods, possible constraints and scope of management strategy i.e. Specific environmental management goals (eco-

system/ multi-functional approach)/ objectives/ targets to be specified on the aspirational values, socio–economic factors.

Stage 2: Planning

- **Identify data gaps**
- **Vulnerability analysis**

This stage identifies data and knowledge gaps and provides research recommendations that may facilitate the planning process. A consideration of what is available; any missing data that could impair the ability to meet project goals; historical data collected by other projects at other times. Types of data include informational, temporal, spatial and historical.

Data may be required to meet environmental performance benchmarks. Data may need to be consistent with the National Environmental Policy and the legal requirements. Data management should harness the best information, relevant to the needs of the ecosystems and relevant stakeholders, and take into account adaptive environmental governance.

Environmental vulnerability is curial to understanding the sustainability and feasibility of human activities. This stage focuses on the practical implementation of adaptations at the community scale. Adaptation initiatives would focus on the risk that is already problematic, integrated into other resource management, disaster preparedness and sustainable development programmes. The main purpose of participatory vulnerability assessments is to identify adoption strategies that are feasible and practical in the communities

and which provide recommendations for disaster risk reduction and environmental management.

Stage 3: Implementation

- **Adaptive Strategies (hard and soft)**

Management strategies designed to enhance understanding, produce resource benefits and improving policies and practice over time. Presented as a way of resolving complex issues, a strong emphasis based on developing collaborative partnerships among citizens, civil society and governments' agencies. Key messages here are to:

1. **Prioritise improvements through existing local adaptive strategies**

Local flood knowledge has implications for local participation approach to community adaptation and mitigation methods. As adaptation choices guide how flood affected communities cope with floods, view from flood prone communities could inforn flood adaption choices. Findings in section 8.5.3 shown various indigenous strategies

2. **Social, economic and ecological impacts**

Once alternative management strategies are formulated, there is the need to assess the social, economic and environmental implications. Environmental Impact Assessments (EIA) are an integral part of the pre-planning stage of most major projects; this is to ensure the scope of the EIA is appropriate for the nature of development and taking into account its location. This stage is undertaken robustly and with proper engagement from stakeholders and also

presents an opportunity to ensure design work is informed and in many areas enhanced by environmental and social considerations.

Stage 4: Assess

- **Monitoring Adapting and learning**

As discussed in section 6.3.1., Social learning is essentially managing change. Evaluation will on if the process allowed for a better understanding and the negotiation of social change in a way that takes cognizance diverse range of views.

Evaluating performance and reviewing management strategy is essential to provide feedback for the next iteration of the process. Initial strategies and processes developed during the first iteration of the strategy are subject to ongoing revision, refinement and updating.

10.4 Theoretical Implications

The inductive stage of the research showed that it was possible to utilise a small sample of NFM case studies to gain insight into NFM processes. In an attempt to lay the groundwork that could lead to future studies or to determine if what is being observed might be explained by a currently existing theory. Three theoretical considerations informed this study, these are sustainability concepts, resilience planning and adaptive co-management.

The logical interpretation of the research findings shows a leaning toward the social dynamics of communities regarding collaborative workings for management. Following the logic of adaptive co- management, communities are empowered through the participatory process, and the inclusion of

invaluable traditional ecological knowledge contributes to adaptive and resilience planning.

The findings in chapter 7 indicate that NFM catchment based approaches are mainly driven by legislative and policy drives. The role of agency in overcoming path dependence and enabling sustainability transitions is crucial in providing guidance on how to facilitate independent community pathways for the future. Developing strategies within epistemological perspectives to understand social-ecological situations could allow cultural hybridity within environmental management and community development projects. This research shows NFM will need to be paired up against local exigencies for it to be viable. Thus the ideal case for resilience planning needs to be revisited to understand further the livelihoods and societal dynamics of communities and how it could be made more sustainable. This is view also echoed by Maclean, K. (2015).

10.5. Contribution to Knowledge

There is a paucity of resilience planning research in Nigeria, to the best of the authors' knowledge; this research is the first to investigate community vulnerability and adaptive planning within Taraba state Nigeria. This research is a synthesis and blends of sustainable practices in two completely different scenarios, providing a feasible planning framework for grassroots adaptation strategy in resilience planning. A framework for flood management tailored and suited to resource-poor regions developed through the synthesis of sustainable flood management practices in the UK and the existing stakeholder management practices in Nigeria. Previous studies have focused on the challenges of flood disaster management. This approach provides feasible

planning, for a grassroots adaptation strategy for resiliency. The NFM framework can integrate various environmental issues from a multi-disciplinary perspective with the added advantage of enhancing community contributions for management.

The work is a contribution to a new understanding on how stakeholders' participation could be strengthened to positively benefit individual and community resilience within SFM, particularly in the Nigerian context. The findings of this study will potentially be of use to a wide audience including academics, social scientist and policy makers involved in flood risk management.

10.6. Study Limitations

Although the research achieved its aims and objectives, some limitations exist in this study. These include restricted boundaries to external and internal validity: the inability to generalise the findings of this study to other community groups, or members because the results represent only the views of community leaders. It is acknowledged that qualitative methods do not intend to state objective truths or generalise results, the findings of this study are limited in application to the participants interviewed. Future research as stated below is needed confirm the initial findings of this study. Another limitation of this study involves the concept of internal validity. The stability and reliability of the results of this study could have been increased had the participants been involved in verifying the data analysis for the accuracy of their intentions. Participant verification was not used in this study's research process. Involving

participants in the data analysis process could strengthen future qualitative research of the.

In addition, another limitation of this study involves potential interviewer and research team bias. Although strong measures were taken to avoid clouding the data collection and analysis, it is likely that some aspect of the personalities of the researchers interacted with the research process. One aspect to consider is the interview protocol, perhaps the interviewer's biases prevented the participants from responding to the most pressing and crucial questions on the research topic. All of these limitations are aspects for consideration and caution in future research.

10.7 Recommendation for Further Research

This research has focussed on stakeholder engagement and adaptive planning. It shows strategies for improving community participation in planning.

- In this work, evaluation was applied to 8 catchment studies. More catchments with different land uses and development conditions should be explored to build on evidence base and improve greater understanding for NFM. A national data collation platform for sharing and dissemination process should be developed across all relevant data-holding agencies, accessible to all for use in NFM planning.
- Findings from the case studies suggest that the wider adoption of the catchment based approach will require a long-term commitment to achieving the range of identified outcomes and more structure platforms for management. There is a real opportunity and need for a leadership role in flood risk management by one responsible authority. The use of

an "honest broker" in existing partnerships scheme has proven successful and would be a recommended approach for NFM scoping studies.

- There is a need develop an evidence base on the costs and benefits of NFM measures, their effectiveness and the potential contributions and conditions under which they are likely to be effective. The process should be continual as various measures taken across different geographical scales.
- The pilots have established some key roles and competencies required to support a successful catchment management: Leadership; facilitation; coordination and technical skills. There is a need to provide some guidance on policy and practical directions for NFM applications to ensure consistent implementation.

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- Findings from the research show the top- down approach to flood management have failed to provide the much-needed impact. A bottom –up approach is advocated to integrate water and land management better; government agencies and stakeholders to help bridge the gap between ad hoc planning and holistic management.
- Future research should also examine the economic impacts and the vulnerability of the agricultural sector losses incurred due to flood impacts, agricultural sustainability within the context of the contemporary socioeconomic and ecological situation. This would help in understanding the scale and for developing a future strategy for management.

- Finally, it is recommended that the utilisation of the framework for vulnerability assessment of other local government areas susceptible to flooding should be explored further with consideration for individual interviews of community members, focus groups and observation.

10.8. Conclusion

Managing climate change impacts such as floods will continue to be challenging. Natural flood management offers a pathway for a consideration of the multiple benefits of ecosystems towards mitigation and adaptation. It is argued that community engagement is crucial in developing NFM strategies and their participation is decisive for community resilience and adaptive planning. New understanding of the opportunities and barriers to involving communities in catchment-based working is crucial in the light of climate change and scientific reliability concerns. Nevertheless, this societal search towards equity, learning and empowerment continuous to be a mantra for new conduits and holistic approaches for environmental management.

REFERENCE

Aberdeenshire Council. 2008. Tarland Catchment Area [ONLINE]. Available at: http://www.aberdeenshire.gov.uk/natural/water/3dee_catchment.gif [Accessed 17 February 2015].

Adebayo, W. A. 2014. Environmental Law and Flood Disaster in Nigeria: The Imperative of Legal Control. *International Journal of Education*. (2) 7.

Adedeji, O.H., Odufuwa, B.O. and Adebayo, O.H., 2012. Building capabilities for flood disaster and hazard preparedness and risk reduction in Nigeria: the need for spatial planning and land management. *Journal of Sustainable Development in Africa*, *14* (1), pp.45-58.

Adedokun MO 2008. A Handbook of Community Development. Ado-Ekiti: Balfak Publisher.

Adeoti, O. 2007. The challenge to managing water resources along the hydrological boundaries in Nigeria. *Water Policy*. (9) Pp: 105-118.

Adeoye, N.O., Ayanlade, A. and Babatimehin, O., 2009. Climate Change and Menace of Floods in Nigerian Cities: Socio-economic Implications. *Advances in Natural and Applied Sciences*, 3(3) pp: 369-377.

Adger, N., Huq, S., Brown, K., Cornway, D and Hulme, M., 2003. Adaptation to Climate Change in the developing world. *Progress in Development Studies*, 3 (3). Pp.179-195.

Adger, W.N., Arnell, N., Tompkins. E. 2005. Successful adaptation to climate change across scales. *Global Environmental Change*. 15. pp. 77–86

Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahashi, 2007: Assessment of adaptation practices, options, constraints and capacity. Climate Change 2007: Impacts, Adaptation and Vulnerability. The contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743.

Agrawal, A. & Gibson, C. C. 1999 Enchantment and disenchantment: the role of community in natural resource conservation, World Development, 27(4), pp. 629 – 649.

Akpabio, E.M. 2007. Assessing integrated water resources management in Nigeria: insights and lessons from irrigation projects in the Cross River Basin. *Water Policy*. (9). Pp149-168.

Al-Amin, A. M. 2013. An Assessment of Nigeria's Preparedness to Environmental Disasters from its Commitment to International Environmental Treaties. *European Scientific Journal*. (9) 32.

Aldrich, D.P. and Meyer, M.A., 2014. Social capital and community resilience. *American Behavioural Scientist*, p.0002764214550299.

Alexander, D.E., 2013. Resilience and disaster risk reduction: an etymological journey. *Natural Hazards and Earth System Sciences*, *13* (11), pp.2707-2716.

Alhojailan, M.I., 2012. Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences*, *1*(1), pp.39-47.

Allen, W., Fenemor, A., Kilvington, M., Harmsworth, G., Young, R. G., Deans, N., Horn, C., Phillips, C., De Oca, O. M., Atari, J., Smith, R. 2011. Building collaboration and learning in integrated catchment management: the importance of social process and multiple engagements approaches. *New Zealand Journal of Marine and Freshwater Research* .45. Pp: 525–39.

Anderson, B.G., Rutherford, I.D., Western A.W., 2008. ROVER: Introducing A Unified Model to Estimate the Hydraulic Resistance of Vegetation. Online from http://mssanz.org.au/modsim05/papers/anderson.pdf

Anderson, M., Woodrow, P., 1998. A framework for analysing capacities and vulnerabilities. *Rising from the Ashes: Development strategies in times of disaster. Cambridge: Harvard University Press (International Relief and Development Project)*.

Andrew, P.S., Pedersen, P.M. & McEvoy, C.D. 2011. "Research Methods and Designs in Sports Management" Human Kinetics

Andrews, 2012. What is social constructionism? *Grounded theory review*, *11*(1), pp.39-46.

Appiah, M., 2001. Co-Partnership in forest management: The Gwira-Banso joint forest management project in Ghana. *Environment, Development and Sustainability*, *3*(4), pp.343-360.

Arce, A., 2003. Value contestations in development interventions: community development and sustainable livelihoods approaches. *Community Development Journal*, *38*(3), pp.199-212.

Asaah, E.K., Tchoundjeu, Z., Leakey, R.R., Takousting, B., Njong, J. and Edang, I., 2011. Trees, agroforestry and multifunctional agriculture in Cameroon. *International Journal of Agricultural Sustainability*, *9* (1), pp.110-119.

Ashley, R. M., Blanksby, J., Chapman, J., Zhou, J., 2007. Towards integrated approaches to reduce flood risk in Urban areas. *Advances in Urban Flood Management*, pp. 415-432.

Banerjee, S. B. 2003. Who sustains whose development? Sustainable development and the reinvention of nature. *Organisation Studies*, 24(1), pp.143-180

Bankoff, G., Frerks, G. and Hilhorst, D., 2004. *Mapping vulnerability: disasters, development, and people*. Routledge.

Bauer, A. and Steurer, R., 2014. Multi-level governance of climate change adaptation through regional partnerships in Canada and England. *Geoforum*, *51*, pp.121-129.

Bauman, Z. 2001. Community. Seeking safety in an insecure world. Polity Press, Cambridge (2001)

Bebbington, A. and Perreault, T., 1999. Social capital, development, and access to resources in highland Ecuador. *Economic Geography*, *75* (4), pp.395-418.

Beierle, T.C., 2002. The quality of stakeholder-based decisions. *Risk Analysis* .22.pp 739–749.

Bell, S., Morse, S. 1999. Sustainability Indicators: Measuring the Immeasurable. Earthscan, London.

Benson, C., Twigg, J. Myers, M. 2001. 'NGO Initiatives in Risk Reduction: An Overview'. *Disasters*. 25(3). pp199-215.

Berg, B.L., 2004. METHODS FOR THE SOCIAL, SCIENCES.

Berger, P.L. and Luckmann, T., 1991. *The social construction of reality: A treatise in the sociology of knowledge* (No. 10). Penguin UK.

Bergfur, J., Demars, B. O. L., Stutter, M. I., Langan, S. J., & Friberg, N. 2012. The Tarland Catchment Initiative and its effect on stream water quality and macroinvertebrate indices. *Journal of Environmental Quality*, *41* (2), 314-321.

Berman, R., Quinn, C. and Paavola, J., 2012. The role of institutions in the transformation of coping capacity to sustainable adaptive capacity. *Environmental Development*, *2*, pp.86-100.

Bernstein, S. 2013. Rio+ 20: sustainable development in a time of multilateral decline. *Global Environmental Politics* .13(4), pp.12-21.

Bezanson, K. A. and Isenman, P. 2012. Governance of new global partnerships: Challenges weakness and lessons.

Bhaskar, R., 1975. Forms of realism.

Bhaskar, R., 2010. *Reclaiming reality: A critical introduction to contemporary philosophy*. Taylor & Francis.

Bhattacharyya, J., 2004.Theorising community development. *Community Development*, *34*(2), pp.5-34.

Biermann, F. 2013. Curtain down and nothing settled: global sustainability governance after the 'Rio+ 20'Earth Summit. *Environment and Planning C: Government and Policy*, 31(6), pp.1099-1114.

Biesbroek, G.R., Swart, R.J. and Van der Knaap, W.G., 2009. The mitigation–adaptation dichotomy and the role of spatial planning. *Habitat International*, 33(3), pp.230-237.

Billett, S. 1996. Evaluating learning as social practice: case studies from workplaces. Evaluation Journal of Australasia 8 (1) pp: 15-26.

Birkholz, S., Muro, M., Jeffrey, P. and Smith, H.M., 2014. Rethinking the relationship between flood risk perception and flood management. *The Science of the Total Environment*, *478*, pp.12-20.

Birkmann, J. and Wisner, B., 2006. *Measuring the unmeasurable: the challenge of vulnerability*. UNU-EHS.

Blackstock, K. L. and Richards, C. 2007. Evaluating stakeholder involvement in river basin planning: a Scottish case study. *Water Policy.* 9 . 493–512

Blackstock, K.L., Kelly, G.J., Horsey, B.L., 2007. Developing and applying a framework to evaluate participatory research for sustainability. *Ecological Economics*. (60) pp: 726–742.

Blaikie, P., T. Cannon, I. Davis and B. Wisner. 1994. At Risk: Natural Hazards, People's Vulnerability and Disaster. Routledge, London.

Blanc, J. Wright. G., Arthur S. 2012. Natural Flood Management knowledge system: Part 2 – The effect of NFM features on the desynchronizing of flood peaks at the catchment scale. CREW Report. Online: http://www.crew.ac.uk/projects/naturalflood-management

BNRCC (Building Nigeria's Response to Climate Change). 2011. National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN).. http://nigeriaclimatechange.org/naspa.pdf.

Bojorquez-Tapia, L., De la Cueva, H., Diaz, S., Melgarejo, D., Alcantar, G., Jose Solares, M., Grobet, G., & Cruz-Bello, G. 2004. Environmental conflicts and nature reserves: redesigning Sierra San Pedro Martir National Park, Mexico. *Biological Conservation* 117(2):111–126.

Bonnell, J. E. 2002. Working Through Environmental Conflict: The Collaborative Learning Approach. *The Journal of Environmental Education*. 33 (3). P: 42.

Borisov, S.V., 2014. Ideas of constructivism in the philosophy of education: from ontology to phenomenology. *Life Science Journal*, *11* (11).

Boyatzis, R.E., 1998. *Transforming qualitative information: Thematic analysis and code development*. Sage.

Bradford et al., 2012. Risk perception- issues for flood management in Europe. *Natural Hazards System Science*. 12. Pp: 2299-2309

Brandt, J., Tress, B., Tress, G. (2000). Multifunctional Landscapes: Interdisciplinary Approaches to Landscape Research and Management. – Conference material for the conference on "multifunctional landscapes". Centre for Landscape Research, Roskilde, October 18-21.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), pp.77-101.

Braun, V., Clarke, V. and Terry, G., 2014. Thematic analysis. *Qual Res Clin Health Psychol*, pp.95-114.

Bressers, H. and Lulofs, K. eds., 2010. *Governance and complexity in water management: Creating cooperation through boundary spanning strategies*. Edward Elgar Publishing.

Brierley G.J., Fryirs, K.A. 2005. Geomorphology and River Management. Applications of the River Styles Framework Blackwell Publishing, Oxford, UK

Brinkmann, S., 2014. *Interview* (pp. 1008-1010). Springer New York.

Brody, S.D., 2003. Measuring the effects of stakeholder participation on the quality of local plans based on the principles of collaborative ecosystem management. *Journal of Planning Education and Research* (22) PP: 407–419.

Brooks, N., S. Anderson, J. Ayers, I. Burton, and I. Tellam. 2011. Tracking adaptation and measuring development. IIED Climate Change Working Paper No. 1. Climate Change Group, International Institute for Environment and Development (IIED), London, UK.

Brown, A., 2015. Climate change and Africa. *Nature Climate Change*, *5*(9), pp.811-811.

Brown, K., 2014. Global environmental change IA social turn for resilience?. *Progress in Human Geography*, *38*(1), pp.107-117.

Brugha, R. and Varvasovszky, Z., 2000. Stakeholder analysis: a review. *Health policy and planning*, *15*(3), pp.239-246.

Bryan, E., Deressa, T.T., Gbetibouo, G.A. and Ringler, C., 2009. Adaptation to climate change in Ethiopia and South Africa: options and constraints. E*nvironmental Science & Policy*, *12* (4), pp.413-426.

Bryman, A. (2012), Social Research Methods, 4th ed, Oxford University Press, New York.

Bryman, A., 2015. *Social Research Methods*. Oxford University press

Bryman, A., and Bell, B. 2003. Business Research Methods. Oxford University Press.

Bryman, A., Bell, E. 2007. Business Research Methods. 2nd Ed. Oxford University Press.

Bulkeley, H., & Betsill, M. 2005. Rethinking Sustainable Cities: Multilevel Governance and the 'Urban' Politics of Climate Change, *Environmental Politics*. 14:1, 42-63.

Bulkeley, H., Jordan, A., Perkins, R. and Selin, H., 2013. Governing sustainability: Rio+ 20 and the road beyond. *Environment and Planning C: Government and Policy*, 31(6), pp.958-970

Bullock, A. Acreman M, 2003. The role of wetlands in the hydrological cycle, *Hydrology* and *Earth Sciences*, 7(3), 358-389

Burr, V. (2003). Social Constructionism (2nd Ed). London: Routledge

Butler, C. and Pidgeon, N., 2011. From 'flood defence 'to 'flood risk management': exploring governance, responsibility, and blame. *Environment and Planning C: Government and Policy*, *29* (3), pp.533-547.

Cairns, J.E., Hellin, J., Sonder, K., Araus, J.L., MacRobert, J.F., Thierfelder, C. and Prasanna, B.M., 2013. Adapting maize production to climate change in sub-Saharan Africa. *Food Security*, *5*(3), pp.345-360.

Calder, I.R. and Aylward, B., 2006. Forest and floods: Moving to an evidence-based approach to watershed and integrated flood management. *Water International*, 31(1), pp.87-99.

Cardona, O. D., 2004. The need for rethinking the concepts of vulnerability and risk from a holistic perspective: a necessary review and criticism for effective risk management. Mapping Vulnerability: Disasters, development and people.17.

Carina, E., Keskitalo, H. 2013. *Climate change and flood risk management: Adaptation and Extreme events at the local level*. Edward Elgar Publishing.

Castro, A.P. and Nielsen, E., 2001. Indigenous people and co-management: implications for conflict management. *Environmental Science & Policy*, *4*(4), pp.229-239.

Cervigni, R., Valentini, R., Santini, M. eds. 2013. Toward Climate-Resilient Development in Nigeria. Directions in Development. Washington, DC: World Bank. Doi:10.1596/978-0-8213-9923-1. License: Creative Commons Attribution CC BY 3.0.

Charmaz, K., 2006. Constructing grounded theory: A practical guide to qualitative research. *Sage Publications Ltd, London*.

Charmaz, K., 2011. Grounded theory methods in social justice research. *The Sage handbook of qualitative research*, *4*, pp.359-380.

Christenson, J. A., & J. W. Robinson (eds.). 1989. Community Development in Perspective. Iowa City, IA: Iowa State University Press.

Christie, F and Hanlon, J. 2000. African Issues: Mozambique and the Great Flood of 2000. The African International Institute in association with James Currey, Oxford and Indiana University Press, Blooming –ton, IN.

Christmann, G.B., Balgar, K. and Mahlkow, N., 2014. Local Constructions of Vulnerability and Resilience in the Context of Climate Change. A Comparison of Lübeck and Rostock. *Social Sciences*, *3* (1), pp.142-159.

Christmann, P.D.G.B. and Ibert, O., 2012. Vulnerability and Resilience in a Socio-Spatial Perspective. *Raumforschung und Raumordnung*, *70*(4), pp.259-272.

Churchill, G. A. 1979. A paradigm for developing better measures of marketing constructs. Journal of Marketing Research, 16, pp: 64-73.

Clarke, V. and Braun, V., 2014. Thematic analysis. In *Encyclopaedia of Critical Psychology* (pp. 1947-1952). Springer New York.

Cohen, D. and Crabtree, B., 2006. Qualitative research guidelines project.

Collier, P., Conway, G. and Venables, T., 2008. Climate change and Africa. *Oxford Review of Economic Policy*, *24*(2), pp.337-353.

Collin, A. 2007. "Community-based natural resource management in Kenya", Management of Environmental Quality: An International Journal, Vol. 18 Iss: 5, pp.531 – 541

Conway, D., & Schipper, E. L. F. 2011. Adaptation to climate change in Africa: Challenges and opportunities identified from Ethiopia. *Global Environmental Change*, 21(1), 227-237.

Cook, B R., Atkinson, M., Chalmers, H., Comins, L., Cooksley, S., Deans, N., Fazey, I., Fenemor, A., Kesby, M., Litke, S., Marshall, D., Spray, C. 2013. Interrogating Participatory Catchment Organisations: cases from Canada, New Zealand, Scotland and the Scottish–English Borderlands. *Geographical Journal*, 179 (3), pp.234-247.

Cook, B. and Lane, S. 2010. Communities of Knowledge: Since and Flood Management in Bangladesh. *Environmental Hazards*. 9 (1). Pp: 8-25.

Cook, B.R., Kesby, M., Fazey, I. and Spray, C., 2013. The persistence of 'normal' catchment management despite the participatory turn: Exploring the power effects of competing frames of reference. *Social Studies of Science*, p.0306312713478670.

Cooke, B., Kothari, U. (Eds.), 2001. Participation: the New Tyranny? Zed Books, London.

Cooksley, S. L. 2007. River Dee Catchment Management Plan Action Pack Dee Catchment Partnership, Aberdeen.

Cortner, H. and Moote, M.A., 1999. *The politics of ecosystem management*. Island Press.

Creswell, J. W. 2007. Research design: Qualitative and quantitative approaches. (2nd Ed). Thousand Oaks, CA: Sage.

Creswell, J.W., 2013. *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Croson, R., Anand, J. and Agarwal, R., 2007. Using experiments in corporate strategy research. *European Management Review*, *4*(3), pp.173-181.

Cross, K.P., 1998. Why learning communities? Why now. *About Campus*, *3* (3), pp.4-11.

Cutter, S. L., Boruff, B. J., Shirley, W. L. 2003. Social vulnerability to environmental hazards. Social Science Quarterly, 84(2). Pp.242-261.

Cvetkovich, G. 2013. Social Trust and the Management of Risk. Routledge.

Dahl, A.L., 2014. Agenda 21. *Global Environmental Change*, pp.527-531.

Darby, S. 1999. Effect of Riparian Vegetation on Flow Resistance and Flood Potential. *Journal of Hydraulic Engineering*. Pp 443- 454.

Daron, J.D., Sutherland, K., Jack, C. and Hewitson, B.C., 2015. The role of regional climate projections in managing complex socio-ecological systems. *Regional Environmental Change*, *15*(1), pp.1-12.

Davidson, D. 1998. Spinning the wheel of empowerment. Planning (3). Pp:14-15.

De Groot, R.S., Alkemade, R., Braat, L., Hein, L. and Willemen, L., 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision-making. *Ecological Complexity*, *7* (3), pp.260-272.

Denton, F., T.J. Wilbanks, A.C. Abeysinghe, I. Burton, Q. Gao, M.C. Lemos, T. Masui, K.L. O'Brien, and K. Warner. 2014. Climate-resilient pathways: adaptation, mitigation, and sustainable development. In: Climate Change. 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1101-1131.

Desanker, P. and Magadza, C., 2001. Climate Change 2001 Impacts, Adaptation, and Vulnerability.

Dessai, S., Adger, W.N., Hulme, M., Turnpenny, J., Köhler, J. and Warren, R., 2004. Defining and experiencing dangerous climate change. *Climatic Change*, *64* (1-2), pp.11-25.

Di Baldassarre, G., Montanari, A., Lins, H., Koutsoyiannis, D., Brandimarte, L. and Blöschl, G., 2010. Flood fatalities in Africa: from diagnosis to mitigation. *Geophysical Research Letters*, *37*(22).

Dickinson, J.L., Shirk, J., Bonter, D., Bonney, R., Crain, R.L., Martin, J., Phillips, T. and Purcell, K., 2012. The current state of citizen science as a tool for ecological research and public engagement. *Frontiers in Ecology and the Environment*, *10*(6), pp.291-297.

Djalante, R., Holley, C. and Thomalla, F. 2011. Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science*, *2*(4), pp.1-14.

Donaghy, M. 2010. Strathspey land managers on NFM measures, funding schemes and their response to climate change impacts. MNV Consulting Ltd.

Douglas, I., Alam, K., Maghenda, M., Mcdonnell, Y., McLean, L. and Campbell, J., 2008. Unjust waters: climate change, flooding and the urban poor in Africa. *Environment and Urbanisation*, *20* (1), pp.187-205.

Easterby-Smith, M, Thorpe, R. & Jackson, P. (2008) "Management Research" 3rd ed, SAGE Publications Ltd., London

Ebigbo, P.O., 2008. Appraising the impact of economic reform programme on micro, small and medium scale enterprises. A Paper Delivered at the 19th Enugu International Trade Fair Colloquium, April 15/ 2008.

EC, 1999. "Environmental Impact Assessments and Geological Repositories for Radioactive wastes". EC Contract B4-3070/9

Economic Communities for the West African States (ECOWAS). 2006, "ECOWAS policy framework for disaster risk reduction". Available at: www.unisdr.org [Accessed 20/03/2015]

Edmund, C. Penning- Rowsell, Edward, P. Evans, Jim W. Hall, Alistair , G.L. Borthwick. 2013. From flood, science to flood policy: the Foresight Future Flooding project seven years on", Foresight, Vol. 15 Iss: 3, pp.190 – 210

Egbinola, C.N., Olaniran, H.D. and Amanambu, A.C. (2015), Flood management in cities of developing countries: the example of Ibadan, Nigeria. *Journal of Flood Risk Management.*

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.

Ely, A., Smith, A., Stirling, A., Leach, M. and Scoones, I., 2013. Innovation politics post-Rio+ 20: hybrid pathways to sustainability? *Environment and Planning C: Government and Policy*. 31(6), pp.1063-1081.

EU, 2006. European Climate Change Programme II: Impacts and Adaptation. 〈 http://ec.europa.eu/environment/climate/eccp_impacts.htm〉.

EU, 2007. Adapting to Climate Change-Green Paper from the Commission, COM (2007) 354 final, 29-6-07. Commission of the European Communities, Brussels

Evans, P. 2004. Development as institutional change: the pitfalls of mono-cropping and the potentials of deliberation *Stud. Comp. Int. Dev.*, 38 (4). pp. 30–52

Evers, M., Nyberg, L. 2013. Coherence and inconsistency of European instruments for integrated river basin management. *International Journal of River Basin Management*, 11 (2), 139-152.

Fabiyi, O.O., Oloukoi, J., 2013. Indigenous Knowledge System and Local Adaptation Strategies to Flooding in Coastal Rural Communities of Nigeria. *Indig. Soc. Dev*. 2, 1–19.

Fabricius, C., Folke, C., Cundill, G. and Schultz, L., 2007. Powerless spectators, coping actors, and adaptive co-managers: a synthesis of the role of communities in ecosystem management. *Ecology and Society*, *12* (1), p.29.

Fagbemi K. 2011. "Nigerian: National progress report on the implementation of the Hyogo Framework for Action (2009-2011). Prevention Web (Assessed January 14, 2016).

Failing, L., Gregory, R. and Harstone, M., 2007. Integrating science and local knowledge in environmental risk management: a decision-focused approach. *Ecological Economics*, *64*(1), pp.47-60.

FAO, 2008. Climate change adaptation and mitigation in the food and agriculture sector. (p. 17). Technical Background Document, Rome, Italy: FAO.

Federal Republic of Nigeria. 2009. Official Gazette, vol.96, Nos. 58-58.

Federal Republic of Nigeria. 2001. Water Resources Management Reform Program: Sector reform proposal (draft 2). Federal Ministry of Water Resources, Abuja.

Federal Republic of Nigeria. 2003. National Water Resources Management Policy, second draft. Federal Ministry of Water Resources, Abuja

Feldman, M., Khademian, A., Ingram, H., Schneider, A. 2006. 'Ways of Knowing and Inclusive Management Practices'. *Public Administration Review*. December (Special Issue), 89–99.

Ferrier, R.C., Jenkins, A., 2010. The catchment management concept. Handbook of catchment management, pp.1-17.

Few, R., Brown, K. and Tompkins, E.L., 2007. Public participation and climate change adaptation: avoiding the illusion of inclusion. *Climate Policy*, *7*(1), pp.46-59.

FGN, 1999. Federal Republic of Nigeria. The constitution of the federal republic of Nigeria. Federal Government Press, Lagos.

FGN, 2003. Nigeria's First National Communication under the United Nations Framework Commission on Climate Change (UNFCCC). Available at: http://www.unfccc.int/resource/docs/natc/nignc1.pdf.

Fisher, R., Maginnis, S., Jackson, W., Barrow, E. and Jeanrenaud, S., 2012. *Linking conservation and poverty reduction: Landscapes, people and power*. Routledge.

Fitton, S. L., Moncaster, A., Guthrie, P. 2014.Flood Alleviation Design: Adopting A Social Perspective. 6th International Conference on Flood Management. September 2014-Sao Paulo-Brazil.

Flyvbjerg, B. 2006. Five misunderstandings about case-study research. *Qualitative Inquiry.* (12) 2. pp: 219-245.

Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 30:8.1–8.33.

Ford, J.D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M. and Pearce, T. 2015. The status of climate changes adaptation in Africa and Asia. *Regional Environmental Change*. 15(5), pp.801-814.

Forino, G., von Meding, J. & Brewer, G.J. 2015. *International Journal of Disaster Risk Sci.* 6: 372. doi:10.1007/s13753-015-0076-z

Fraser, E.D., Dougill, A.J., Mabee, W.E., Reed, M. and McAlpine, P. 2006. Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *Journal of Environmental Management*, 78(2), pp.114-127.

FRMRC, 2008. Flood Risk Management Research Consortium website

Gardiner, S.M., 2011. *A perfect moral storm: The ethical tragedy of climate change*. Oxford University Press.

Garner, P., 1989. The Bamako initiative. *BMJ: British Medical Journal*, *299*(6694), p.277.

Geels, F.W., McMeekin, A., Mylan, J. Southerton, D. 2015. A critical appraisal of Sustainable Consumption and production research: The reformist, revolutionary and reconfiguration positions. *Global Environmental Change*. Vol. 34, pp1-12. Available online: http://www.sciencedirect.com/science/article/pii/S0959378015000813

Georgiou, S. and Turner, R.K., 2012. *Valuing ecosystem services: the case of multi-functional wetlands*. Routledge.

Ghauri, P. and Grønhaug, K. 2002. (2nd Ed.), Research Methods in Business Studies, Harlow, UK: FT Prentice Hall.

Gibbs, D. & Jonas, A. 2000. Governance and regulation in local environmental policy: the utility of a regime approach*, Geoforum*, 31, pp. 299–313.

Gilgun, J. F. 1994. Hand into a glove: The grounded theory approach and social work practice research. In E. Sherman & W. J. Reid (Eds.), *Qualitative research in social work* (pp. 115–125). New York: Columbia University Press.

Gilvear, D. J., Spray, C. J., & Casas-Mulet, R. 2013. River rehabilitation for the delivery of multiple ecosystem services at the river network scale. *Journal of Environmental Management*, *126*, 30-43.

Given, L. M. (Ed.). 2008. The Sage Encyclopaedia of Qualitative Research Methods. Sage: Thousand Oaks, CA, Vol.2, pp.697-698

Glaser & Strauss. 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine.

Gleeson, B. & Low, N. 2000. Cities as consumers of the world's environment, in N. Low, B. Gleeson, I. Elander & R. Lidskog (Eds) Consuming Cities: The Urban Environment in the Global Economy after the Rio Declaration (London: Routledge), pp. 1–29.

Goulding, C., 2005. Grounded theory, ethnography and phenomenology: A comparative analysis of three qualitative strategies for marketing research. *European Journal of Marketing*, *39*(3/4), pp.294-308.

Green, D., & Raygorodetsky, G. (2010). Indigenous knowledge of a changing climate. Climatic Change, 100, 239-242.

Green, L.W. and Mercer, S.L., 2001. Can public health researchers and agencies reconcile the push from funding bodies and the pull from communities?. *American journal of public health*, *91*(12), pp.1926-1929.

Groenfeldt, D. 2009. Multifunctional agricultural policies and practices in Europe and relevance for Monsoon Asia. Water and Culture Institute.

Gunderson, L. H., Holling, C. S. & Light, S. S. 1995. Barriers were broken and bridges built: a synthesis, in L. H. Gunderson, C. S. Holling & S. S. Light (Eds) Barriers and Bridges to the Renewal of Ecosystems and Institutions, pp. 489 – 533 (New York: Columbia University Press).

Haasnoot, M., Middelkoop, H., Van Beek E., Van Deursen W. A. 2011. Method to Develop sustainable water management strategies for an uncertain future. *Sustainable Development* 19.pp:369-381.

Habermas, J., 1987. Theory of Communicative Action. Cambridge, Polity Press.

Hall, P.A. and Lamont, M. eds., 2013. *Social resilience in the neoliberal era*. Cambridge University Press.

Hambleton, R.K. 1993. Translating achievement tests for use in cross-national studies. *European Journal of Psychological Assessment*, 9(1), 57-58.

Hammersley, M., Atkinson, P., 2007. *Ethnography: Principles in practice*. Routledge.

Hancock, D.R. and Algozzine, B., 2015. *Doing case study research: A practical guide for beginning researchers*. Teachers College Press.

Harris A. 2011. Out of sight but no longer out of mind: A climate of change for marine conservation in Madagascar. *Madagascar Conservation & Development* 6: 7-14

Harvey, D. 2010. The enigma of capital and the crises of capitalism. Profile Books, London.

Hauck, J., Schweppe-Kraft, B., Albert, C., Görg, C., Jax, K., Jensen, R., Fürst, C., Maes, J., Ring, I., Hönigová, I. and Burkhard, B., 2013. The promise of the ecosystem services concept for planning and decision-making. *Gaia*, *22* (4), p.232.

Hegger, D.L.T., Green, C., Driessen, P.P.J., Bakker, M.H., Dieperink, C., Crabbé, A., Deketelaere, K., Delvaux, B., Suykens, C., Beyers, J.C. and Fournier, M. 2013. Flood Risk Management in Europe: Similarities and Differences between the STAR-FLOOD consortium countries, Available at http://dspace.library.uu.nl/bitstream/handle/1874/314882/similarities_and_differences_between_the_star_flood_consortium_countries.pdf?sequence=1 (accessed 5/01/2016)

Hellmuth, M.E., Moorhead, A., Thomson, M.C. and Williams, J., 2007. *Climate risk management in Africa: Learning from Practice* (No. P01-261). Columbia University, International research institute for climate and Society (IRI).

Hemingway, L. and Priestley, M., 2014. Natural hazards, human vulnerability and disabling societies: a disaster for disabled people? *Review of Disability Studies: An International Journal*, *2*(3).

Hezri, A.A. and Dovers, S.R. 2006. Sustainability indicators, policy and governance: Issues for ecological economics. *Ecological Economics*, 60 (1), pp.86-99.

Hitz, S. and Smith, J., 2004. Estimating global impacts from climate change. *Global Environmental Change*, *14*(3), pp.201-218.

Holand, I.S. and Lujala, P., 2013. Replicating and adapting an index of social vulnerability to a new context: a comparison study for Norway. *The Professional Geographer*, *65*(2), pp.312-328.

Holling, C.S., 1973. Resilience and stability of ecological systems. *Annual review of ecology and systematics*, pp.1-23.

Holstead, K., Kenyon, W., Rouillard, J. 2012. Factors that affect uptake of natural flood management features by farmers in Scotland: A review. Published by The James Hutton Institute on behalf of CREW – Scotland's Centre of Expertise for Waters.

Holstead, K.L and Wilkinson, M. 2013. UK and Ireland natural flood management practitioners' workshop, CD2012/23. Available at www.crew.ac.uk/publications

Hooper, B. P., 2005. Integrated river basin governance: learning from international experiences. IWA Publishing.

Howgate, O. and Kenyon, W. 2008. Community co-operation with natural flood management: A case study in the Scottish Borders. *Area*. 41(3), p. 329-340.

Huang, G., 2012. From Confining to Sharing for Sustainable Flood Management. *Sustainability*, *4* (7), pp.1397-1411.

Hughes, T.P., Baird, A.H., Bellwood, D.R., Card, M., Connolly, S.R., Folke, C., Grosberg, R., Hoegh-Guldberg, O., Jackson, J.B.C., Kleypas, J. and Lough, J.M., 2003. Climate change, human impacts, and the resilience of coral reefs. *Science*, *301* (5635), pp.929-933.

Hulme, M. and Mahoney, M., 2010. Climate change: What do we know about the IPCC?. *Progress in Physical Geography*.

Huntjens, P., Lebel, L., Pahl-Wostl, C., Camkin, J., Schulze, R. and Kranz, N., 2012. Institutional design propositions for the governance of adaptation to climate change in the water sector. *Global Environmental Change*, 22(1), pp.67-81.

Huntjens, P., Pahl-Wostl, C., Rihoux, B., Schlüter, M., Flachner, Z., Neto, S., Koskova, R., Dickens, C. and Nabide Kiti, I., 2011. Adaptive water management and policy learning in a changing climate: a formal comparative analysis of eight water management regimes in Europe, Africa and Asia. *Environmental Policy and Governance*, *21* (3), pp.145-163.

Iacob, O., Rowan, J.S., Brown, I. and Ellis, C., 2014. Evaluating wider benefits of natural flood management strategies: an ecosystem-based adaptation perspective. *Hydrology Research*. 45(6), pp.774-787.

Ifeanyi, A. 2002. Environmental impact assessment as a tool for sustainable development: The Nigerian experience. Proceedings of the FIG XXII International Congress, April 19-26, Washington, D.C. USA, and pp: 1-13.

IISD, IUCN, SEI, SDC, Intercooperation, 2003, Livelihoods and Climate Change: Combining Disaster Risk Reduction, Natural Resource Management and Climate Change Adaptation in a New Approach to the Reduction of Vulnerability and Poverty, International Institute for Sustainable Development, Winnipeg, Canada

IPCC, 2007. Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. The contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC, 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA. Pp: 582

IPCC, 2014. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. The contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Irvin, R.A. and Stansbury, J., 2004. Citizen participation in decision making: is it worth the effort?. *Public administration review*, *64*(1), pp.55-65.

Irwin, A. 1995. Citizen science: a study of people, expertise and sustainable development Routledge, London.

Isa, M. 2015. Flood sacks 15,000 families in Taraba. *Daily Trust*. 22nd October 2015.

Ishaku, H.T., Nzukun, Y., Haruna, A. 2011. Application of Geographic Information System (GIS) for the Control of Floods in Jalingo Metropolis Taraba State Nigeria.

Ison, R., Röling, N. and Watson, D., 2007. Challenges to science and society in the sustainable management and use of water: investigating the role of social learning. *Environmental Science & Policy*, *10*(6), pp.499-511.

Jabareen, Y., 2013. Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk. *Cities*, *31*, pp.220-229.

Jacob, S.A. and Furgerson, S.P., 2012. Writing interview protocols and conducting interviews: Tips for students new to the field of qualitative research. *The Qualitative Report*, *17* (42), pp.1-10.

Jerome, U. O. 2012. Enhancing the Implementation of Sustainable Development in Nigeria through Legal Strategies. *Journal of Sustainable Development*. (8)1. Pp. 86-100

Johnson R., Waton M., McOuat E. 2008. The Way Forward for Natural Flood Management in Scotland. A report for Scottish Environment LINK. Report ref: MNV/WWF/0808/1038

Johnson, R.C., Piper, B.S., Acreman, M.C. & Gilman, K. 1991. Flood alleviation in the Upper Strathspey: modelling and environment study. Report to the Nature Conservancy Council for Scotland

Johnstonova, A., Panter, H., Badger, MacDonald, J., Richardson, R. 2012. Incorporating Ecosystems Services into Flood Risk Management Appraisal with a focus on Natural Flood Management. Agriculture and the Environment IX, Valuing Ecosystems: Policy, Economic and Management Interactions.

Joseph, J., 2014. The EU in the Horn of Africa: building resilience as a distant form of governance. JCMS: Journal of Common market studies, 52(2), pp.285-301.

Junker, B., Buchecker, M. and Müller-Böker, U., 2007. Objectives of public participation: Which actors should be involved in the decision making for river restorations? *Water Resources Research*, *43*(10).

Kakabadse, N.K., Rozuel, C. and Lee-Davies, L., 2005. Corporate social responsibility and stakeholder approach: a conceptual review. *International Journal of Business Governance and Ethics.* 1(4), pp.277-302.

Kates, R.W., Travis, W.R. and Wilbanks, T.J., 2012. Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences*, *109*(19), pp.7156-7161

Keating, A., *et al*. 2014. Operationalizing Resilience Against Natural Disaster Risk: Opportunities, Barriers and A Way Forward. Zurich Flood Resilience Alliance.

Keeney, R.L., McDaniels, T.L., 2001, 'A framework to guide thinking and analysis regarding climate change policies', Risk Analysis 21, 989–1000.

Keim, M.E., 2008. Building human resilience: the role of public health preparedness and response as an adaptation to climate change. *American Journal of Preventive Medicine*, *35* (5), pp.508-516.

Kelman, I., Gaillard, J.C. and Mercer, J., 2015. Climate change's role in disaster risk reduction's future: Beyond vulnerability and resilience. *International Journal of Disaster Risk Science*, *6*(1), pp.21-27.

Ker Rault, A.P. 2008. Public Participation in Integrated Water Management, A Wicked Process for a Complex Societal Problem. PhD thesis, Cranfield University.

Kesby, M., 2005. Retheorizing empowerment-through-participation as a performance in space: Beyond tyranny to transformation. *Signs*, *30*(4), pp.2037-2065.

Kithiia, J., 2011. Climate change risk responses in East African cities: need, barriers and opportunities. *Current Opinion in Environmental Sustainability*, *3* (3), pp.176-180.

Knippenberg, R., Alihonou, E., Soucat, A., Oyegbite, K., Calivis, M., Hopwood, I., Niimi, R., Diallo, M.P., Conde, M. and Ofosu-Amaah, S., 1997. Implementation of the Bamako initiative; strategies in Benin and Guinea. *Int J Health Plan Manage*, *12*, pp.S1-28.

Knutti, R., Furrer, R., Tebaldi, C., Cermak, J., Gerald A. M., 2010: Challenges in Combining Projections from Multiple Climate Models. *Journal of Climate*. (23) 10. pp: 2739–2758. [Online]: doi: http://dx.doi.org/10.1175/2009JCLI3361.1

Knutti, R., Sedláček, J. (2013). Robustness and uncertainties in the new CMIP5 climate model projections. Nature Climate Change, 3(4), 369-373.

Kogbe, C. A. 1976. Geology of Nigeria. Elizabethan Publishing Company.

Kranz, N., Dagmar, R., Mita, P. 2006: Public Participation in European River Basin Management - Lessons from the HarmoniCOP project. Ecologic Briefs on International Relations and Sustainable Development. R. Andreas Kraemer and Sascha Müller-Kraenner. Berlin: Ecologic - Institute for International and European Environmental Policy.

Krüger, F., Bankoff, G., Cannon, T., Orlowski, B. and Schipper, E.L.F. eds., 2015. *Cultures and disasters: Understanding cultural framings in disaster risk reduction*. Routledge.

Kundzewicz, Z.W., Kanae, S., Seneviratne, S.I., Handmer, J., Nicholls, N., Peduzzi, P., Mechler, R., Bouwer, L.M., Arnell, N., Mach, K. and Muir-Wood, R. 2014. Flood risk and climate change: global and regional perspectives. *Hydrological Sciences* Journal, 59(1), 1-28.

Ladan, T. M. 2012. Review of NESREA Act 2007 and Regulation 2009-2011: A New Dawn in Environmental Compliance and Enforcement in Nigeria, *8/1*

Law, Environment and Development Journal. P.116. Available at: www.lead-journal.org/content/12116.pdf

Lafferty, W.M. and Eckerberg, K., 2013. From the Earth Summit to Local Agenda 21: working towards sustainable development (Vol. 12). Routledge.

Lane, M.B. and McDonald, G., 2005. Community-based environmental planning: operational dilemmas, planning principles and possible remedies. *Journal of environmental planning and management*, *48*(5), pp.709-731.

Lane, M.B., McDonald, G.T. and Morrison, T.H., 2004. Decentralisation and environmental management in Australia: a comment on the prescriptions of the Wentworth Group. *Australian Geographical Studies*, *42*(1), pp.103-115.

Langan, S. 2006. Opportunities and constraints for using best management practices: some lessons from the Tarland Catchment Initiative. Agriculture and the environment VI – managing rural diffuse pollution (ed. by L.Gairns, K.Crighton and B.Jeffrey). Proceedings of the SAC and SEPA Biennial Conference, Edinburgh, 5–6 April 2006.

Lavell, A., Oppenheimer, M., Diop, C., Hess, J., Lempert, R., Li, J., Muir-Wood, R. and Myeong, S., 2012. Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience. *Managing the risks of extreme events and disasters to advance climate change adaptation*, pp.25-64.

Lawrence, A., 2006. No personal motive? Volunteers, biodiversity, and the false dichotomies of participation. *Ethics, Place and Environment* 9, 279–298.

Leary, N., 2012. Climate Change and Adaptation. Earth scan.

Lee, Y.J., 2014. Social vulnerability indicators as a sustainable planning tool. *Environmental Impact Assessment Review*, *44*, pp.31-42.

Leemans, R. and Solecki, W. 2013. Redefining environmental sustainability. Editorial overview. *Current Opinion in Environmental Sustainability*. 5: 272-277

Leemans, R. and Eickhout, B., 2004. Another reason for concern: regional and global impacts on ecosystems for different levels of climate change. *Global environmental change*, *14*(3), pp.219-228.

Lei, Y., Yue, Y., Zhou, H. and Yin, W., 2014. Rethinking the relationships of vulnerability, resilience, and adaptation from a disaster risk perspective. *Natural Hazards*, *70*(1), pp.609-627.

Lemos, M. C., Agrawal, A., Eakin, H., Nelson, D. R., Engle, N. L., & Johns, O. 2013. Building adaptive capacity to climate change in less developed countries. In Climate science for serving society .pp. 437-457. Springer Netherlands.

Lempert, R., Kalra, N., Peyraud, S., Mao, Z., Tan, S. B., Cira, D., & Lotsch, A. 2013. Ensuring robust flood risk management in Ho Chi Minh City. World Bank Policy Research Working Paper, (6465).

Limbu, M., Wanyagi, L. Ondiek, B., Munsch, B. Kiilu, K. 2015. Kenya Interagency Rapid Assessment Mechanism (KIRA): A Bottom-up Humanitarian Innovation from Africa. *Procedia Engineering*.Vol. 107. pp.59-72.

Liu, H.Y. and Kobernus, M., 2016. Citizen Science and Its Role in Sustainable Development: Status, Trends, Issues, and Opportunities. *Analysing the Role of Citizen Science in Modern Research*, p.147.

Liu, J., Dietz, T., Carpenter, S.R., Folke, C., Alberti, M., Redman, C.L., Schneider, S.H., Ostrom, E., Pell, A.N., Lubchenco, J. and Taylor, W.W., 2007. Coupled human and natural systems. *AMBIO: a journal of the human environment*, *36*(8), pp.639-649.

Locke, K., 2002. The grounded theory approach to qualitative research.

Longhurst, R., 2003. Semi-structured interviews and focus groups. *Key methods in geography*, pp.117-132

Loorbach, D., 2007. *Transition management: a new mode of governance for sustainable development*.

Macnaghten, P. and Urry, J., 1998. *Contested natures* (Vol. 54). Sage.

Madzwamuse, M. 2011. Climate Governance in Africa-Adaptation Strategies and Institutions

Magis, K. 2010. Community resilience: An indicator of social sustainability. *Society and Natural Resources*, 23(5), 401-416.

Mander, U., Helming, K. and Wiggering, H., 2007. Multifunctional land use: meeting future demands for landscape goods and service. *In Multifunctional land use*. Pp1-13. Springer Berlin Heidelberg.

Mansuri, G., and V. Rao. 2012. Localising Development: Does Participation Work?, A World Bank Policy Research Report, World Bank, Washington DC.

Manyena, S.B., 2006. The concept of resilience revisited. *Disasters*, *30* (4), pp.434-450.

Marshall, G. 2012. Economics for collaborative environmental management: renegotiating the commons. Routledge.

Marshall, K., Blackstock, K. L. and Dunglinson, J. 2010. A contextual framework for understanding good practice in integrated catchment management. *Journal of Environmental Planning and Management* .53. P: 63–89

Martin, A., Sherrington, J., 1997. Participatory research methods: implementation, effectiveness and institutional context. *Agricultural Systems*. 55, 195–216.

Mason, M., 2012. *Environmental democracy: A contextual approach*. Routledge.

Matthews, T., Mullan, D., Wilby, R.L., Broderick, C. and Murphy, C., 2016. Past and future climate change in the context of memorable seasonal extremes. *Climate Risk Management*, *11*, pp.37-52.

Mawdsley, J.R., O'Malley, R.O.B.I.N. and Ojima, D.S., 2009. A review of climate-change adaptation strategies for wildlife management and biodiversity conservation. *Conservation Biology*, *23*(5), pp.1080-1089.

Maxwell. J. A. 1998. 'Designing a qualitative study', in L. Bickman & D.J. Rog (Eds.), Handbook of Applied Social Science Research Methods. Thousand Oaks, CA: Sage

McOuat, E.I. 2005. Distribution of Large Woody Debris in the Devon catchment: potential implications for riparian management. MSc Thesis, University of Stirling

Mechler, R. 2004. Natural Disaster Risk Management and Financing Disaster Losses in Developing Countries. Verlag Versicherungswirtschaft Gmbh. Karlsruhe, DE

Melchias, G. (2001). Biodiversity and conservation. Enfield: Science.

Mercer, J., Kelman, I., Taranis, L. and Suchet-Pearson, S., 2010. Framework for integrating indigenous and scientific knowledge for disaster risk reduction. *Disasters*, *34*(1), pp.214-239.

Merilä, J. and Hendry, A.P., 2014. Climate change, adaptation, and phenotypic plasticity: the problem and the evidence. *Evolutionary Applications*, *7*(1), pp.1-14.

Merriam, S.B. & Caffarella, R.S. 1999. Learning in adulthood (2ed.). San Francisco: Jossey-Bass

Michel-Kerjan, Erwann, Stefan Hochrainer-Stigler, Howard Kunreuther, Joanne Linnerooth-Bayer, Reinhard Mechler, Robert Muir-Wood, Nicola Ranger, Pantea Vaziri, and Michael Young. 2013. Catastrophe risk models for evaluating disaster risk reduction investments in developing countries. *Risk Analysis,* 33(6), 984-999.

Michener, V. 1998. The participatory approach: contradiction and co-option in Burkina Faso. *World Development* (26) pp: 2105–2118.

Miles, M.B, and Huberman, A.M. 1994. Qualitative Data Analysis, 2nd Ed., p. 10-12. Newbury Park, CA: Sage

Moore, C. M. 2001. What is a community? In: P. Brick, D. Snow & S. Van De Wetering (Eds) Across the Great Divide: Explorations in Collaborative Conservation and the American West, pp. 71 – 76 (Washington DC: Island Press).

Morandi, B., Piégay, H., Lamouroux, N. and Vaudor, L., 2014. How is success or failure in river restoration projects evaluated? Feedback from French restoration projects. *Journal of environmental management*, 137, pp.178-188.

Morris, J. and Hess, T., 2007.Submission of Evidence – Rural flooding, Unpublished. 6pp. FRMRC . Flood Risk Management Research

Consortium website http://www.floodrisk.org.uk/content/view/89/1/. [Accessed July 14, 2014].

Morse, J.M., 2012. The implications of interview type and structure in mixed-method designs. *Gubrium, JF*, pp.193-204.

Moss, R.H., Meehl, G.A., Lemos, M.C., Smith, J.B., Arnold, J.R., Arnott, J.C., Behar, D., Brasseur, G.P., Broomell, S.B., Busalacchi, A.J. and Dessai, S., 2013. Hell and high water: practice-relevant adaptation science. *Science*, *342*(6159), pp.696-698.

Muller, M. 2007. Adapting to climate change: water management for urban resilience. *Environ Urban*. 19(1):99–113

Murphy, B. L., Anderson, G. S., Bowles, R., & Cox, R. S. 2013. Planning for disaster resilience in rural, remote, and coastal communities: moving from thought to action. Journal of emergency management (Weston, Mass.), 12(2), 105-120.

Murphy, E., Dingwall, R., Greatbatch, & Parker, P. 1998. Qualitative research methods in health technology assessment: a review of the literature. *Health Technology Assessment* .2 (16).

Nachmias, F. C. and Nachmias, D. 2008. Research Methods in the Social Science. Worth Publishers.

NASPA-CCN. 2011. National Adaptation Strategy Plan of Action for Climate Change in Nigeria (NASPA-CCN), BNRCC Project Report. Available at: http://nigeriaclimatechange.org/naspa.pdf.

National Emergency Management Agency (NEMA). 2010. "National Disaster Management Framework (NDMF). Online: http://www.preventionweb.net/files/21708_nigherianationaldisastermanagementf.pdf>.

NDMF (2010). National Disaster Management Framework (NDMF). A Publication of National Emergency Management Agency, Abuja, Nigeria.

NESREA Act. 2007. The United Nations Environment Programme (UNEP). Online from: www.unep/org/unep/sub 1.htm . [Accessed 19/03/2015].

Niang, I., O.C. Ruppel, M.A. Abdrabo, A. Essel, C. Lennard, J. Padgham, and P. Urquhart, 2014: Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. The contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1199-1265.

Nicholson, A. R., Wilkinson, M. E., O'Donnell, G. M., & Quinn, P. F. 2012. Runoff attenuation features a sustainable flood mitigation strategy in the Belford catchment, UK. *Area*, *44*(4), 463-469.

Nicholson, A., Quinn, P., Owen, G., Hetherington, D., Piedra Lara, M. and O'Donnell, G., 2016, April. Scales of Natural Flood Management. In *EGU General Assembly Conference Abstracts* (Vol. 18, p. 13615).

Norris, F.H., Stevens, S.P., Pfefferbaum, B., Wyche, K.F. and Pfefferbaum, R.L., 2008. Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American journal of community psychology*, 41(1-2), pp.127-150.

NPC, 2006. Nigeria Population Commission, 2005 Population Census of the Federal Republic of Nigeria. Nigeria Population Commission, Abuja

Nur, A., Ayuni, N.K. 2004. Hydro-Geo-electrical Study in Jalingo Metropolis and Environs of Taraba state, NE Nigeria. *Global Journal of Geological Science*. 2(1). Pp: 110-109.

Nyamu-Musembi, C. and Cornwall, A., 2004. What is the" rights-based approach" all about?: perspectives from international development agencies.

Nyong, A., Adesina, F., & Elasha, B. O. (2007). The value of Indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. Mitigation and Adaptation Strategies. Global Change, 12, 787-797

O'Connell, P.E., Beven , K. J., Carney, J. N., Clements, R. O., Ewen, J., Fowler, H., Harris, G. L., Hollis, J., Morris, J., O'Donnell, G. M., Packman, J. C., Parkin, A., Quinn P. F. and Rose S. C .2004. Review of Impacts of Rural Land Use and Management on Flood Generation. Part A: Impact Study Report. Report to Defra/Environment Agency R&D Technical Report (FD2114)

Obeta, C. M. 2014. An institutional approach to flood disaster management in Nigeria: the need for a preparedness plan. *British Journal of Applied Science & Technology*. 4 (33): 4575-4590.

Odemerho, F.O., 2015. Building climate change resilience through bottom-up adaptation to flooding risk in Warri, Nigeria. *Environment and Urbanisation*, *27* (1), pp.139-160.

Ogbodo, S.G., 2010. The Paradox of the Concept of Sustainable Development under Nigeria's Environmental Law. *Journal of Sustainable Development*, *3* (3), p.201.

Okali, C., Sumberg, J., Farrington, J., 1994. Farmer Participatory Research; rhetoric and reality. Intermediate Technology Publications, London.

Okello, M.M. and Kiringe, J.W. 2004. , "*Threats to biodiversity and their implications in protected and adjacent dispersal areas of Kenya*", *Journal of Sustainable Tourism*, Vol. 12 No. 1, pp. 55-69. ,

Olsson, L., Jerneck, A., Thoren, H., Persson, J. and O'Byrne, D., 2015. Why resilience is unappealing to social science: Theoretical and empirical investigations of the scientific use of resilience. *Science advances*, *1*(4), p.e1400217.

Omofonmwan, S.I., Osa-Edoh, G.I. 2008. The Challenges of Environmental Problems in Nigeria. *Journal of Human Ecology*. 23(1).pp: 53-57.

Omole, D. O. 2013. Sustainable groundwater exploitation in Nigeria. *Journal of Water Resource and Ocean Science*. 2(2),pp: 9-14.

Oppenheimer, M. and Petsonk, A., 2005. Article 2 of the UNFCCC: historical origins, recent interpretations. *Climatic change*, *73*(3), pp.195-226.

Oruonye, E. D. 2013. An Assessment of Flood Risk Perception and Response in Jalingo Metropolis, Taraba State, Nigeria. *International Journal of Forest, Soil and Erosion*, Vol. 3. No. 4. Pp. 113 - 117.

Oruonye, E.D. 2015. Assessment of the Impact of Land-use Changes Along the Floodplains of River Lamurde, Jalingo LGA, Nigeria. Journal of Forests, Vol. 2(1), pp. 1-13

Oruonye, E.D., Abbas, B. 2010. The Geography of Taraba State, Nigeria. Fab Educational Books (in - press).

Pahl-Wostl, C. 2002. Towards sustainability in the water sector: the importance of human actors and processes of social learning. *Aquatic Sciences* 64:394–411.

Pahl-Wostl, C. 2009. A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Glob. Environ. Change (2009)

Pahl-Wostl, C., 2007. Transitions towards adaptive management of water facing climate and global change. *Water Resources Management*, *21* (1), pp.49-62.

Pahl-Wostl, C., E. Mostert, and D. Tàbara. 2008. The growing importance of social learning in water resources management and sustainability science. *Ecology and Society* 13(1): 24. [online] URL: http://www.ecologyandsociety.org/vol13/iss1/art24/

Pahl-Wostl, C., M. Craps, A. Dewulf, E. Mostert, D. Tàbara, and T. Taillieu. 2007. Social learning and water resources management. *Ecology and Society* 12(2): 5. [online] URL: http://www.ecology andsociety.org/vol12/iss2/art5/.

Pareek, A. and Trivedi, P.C., 2011. Cultural values and indigenous knowledge of climate change and disaster prediction in Rajasthan, India. *Indian Journal of Traditional Knowledge*, *10*(1), pp.183-189.

Parsons, A .S. 1978. Interpretive Sociology: The theoretical significance of verstehen in the constitution of social reality. *Human Studies*. Volume 1, Issue 1. pp: 111-137.

Patt, A.G. and Schröter, D., 2008. Perceptions of climate risk in Mozambique: implications for the success of adaptation strategies. *Global Environmental Change*, *18*(3), pp.458-467.

Patton, M. Q. 2002. Qualitative research and evaluation methods (3rd Ed.). Thousand Oaks, CA: Sage

Patton, M.Q., 2005. *Qualitative research*. John Wiley & Sons, Ltd.

Paul, C., Demald Van Niekerk, Gerrit Van Der Waldt. 2016. "An exploration of Objectivism and social constructivism within the context of disaster risk". *Disaster Prevention and Management*. Vol 25. Is: 2. Pp: 261-274.

Pelling, M. 2012. *The vulnerability of cities: natural disasters and social resilience*. Earthscan.

Penning-Rowsell, E.C., Evans, E.P., Hall, J.W. and Borthwick, A.G., 2013. From flood science to flood policy: the Foresight Future Flooding project seven years on. *Foresight*, *15* (3), pp.190-210.

Perrons, D. and Skyers, S., 2003. Empowerment through participation? Conceptual explorations and a case study. *International Journal of Urban and Regional Research*, *27*(2), pp.265-285.

Persson, A. 2011. Institutionalising Climate Adaptation Finance Under the UNFCCC and Beyond: Could an Adaptation 'Market' Emerge? Stockholm Environment Institute Working Paper 2011-03.

Petermann, T. (Editor) 2008. Towards Climate Change Adaptation - Building Adaptive Capacity in Managing African Transboundary River Basins. InWEnt, Zschortau, Germany

Pettenger, M. E. 2007. 'Introduction: Power, Knowledge and the Social Construction of Climate Change', in Pettenger, M. E., (ed.), *The Social Construction of Climate Change: Power, Knowledge, Norms, Discourses*. Hampshire: Ashgate Publishing, pp. 1-20.

Piaget J. 1977. The development of thought: Equilibration of cognitive structures. (A. Rosin, Trans). New York: The Viking Press

Pinkett, R.D., 2000, April. Bridging the digital divide: Sociocultural Constructionism and an asset-based approach to community technology and community building. In *81st Annual Meeting of the American Educational Research Association (AERA), New Orleans, LA* (pp. 24-28).

Pitt M. 2008. The Pitt Review: learning lessons from the 2007 floods. Cabinet Office.

Postel, S. and Richter, B., 2012. Rivers for life: managing water for people and nature. Island Press

POSTNOTE, 2011. *Natural Flood Management,* POSTNOTE no. 396 December 2011, Houses of Parliament, Parliamentary Office of Science and Technology.

Pretty, J. N. 1995. Participatory learning for sustainable agriculture. *World Development*, 23 (8), pp. 1247–1263

Price, M.F. & Butt, N. 2000 Forests in Sustainable Mountain Development: a state of knowledge report for 2000. CAB International, Wallingford. 590pp

Rayner, S., Malone E.L. (eds), 1998, Human Choice and Climate Change. Volume 1: The Societal Framework, Battelle Press, Columbus, OH, USA.

RBDA, 1986. River Basins Development Authorities Act (C.A.P. 396) (1986)

Reed, M.S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation*. 141. 2417-2431.

Reed, M.S., 2007. Participatory technology development for agroforestry extension: an innovation-decision approach. *African Journal of Agricultural Research* 2, 334–341.

Reed, M.S., Dougill, A.J., Baker, T., 2008. Participatory indicator development: what can ecologists and local communities learn from each other? *Ecological Applications*. 18, 1253–1269

Reed, M.S., Fraser, E.D. and Dougill, A.J., 2006. An adaptive learning process for developing and applying sustainability indicators with local communities. *Ecological Economics*, 59 (4), pp.406-418.

Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C.H. and Stringer, L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of environmental management*, *90*(5), pp.1933-1949.

Reinhard S., Markus, E. L. Astrid, K. Andre´ M. 2005. Corporations, Stakeholders and Sustainable Development I: A Theoretical Exploration of Business–Society Relations. *Journal of Business Ethics*. 61. pp: 263–281.

Renting, H., Rossing, W.A.H., Groot, J.C.J., Van der Ploeg, J.D., Laurent, C., Perraud, D., Stobbelaar, D.J, Van Ittersum, M.K. 2009. Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *Journal of Environmental Management*. 90 (2).

Reser, J.P. and Swim, J.K., 2011. Adapting to and coping with the threat and impacts of climate change. *American Psychologist*, *66*(4), p.277.

Richards, C., Blackstock, K.L., Carter, C.E., 2004. Practical Approaches to Participation SERG Policy Brief No. 1. Macauley Land Use Research Institute, Aberdeen.

Rigasa *et al*. 2015. Flood Risk Reduction in Nigeria: A Functional Strategy for Vulnerable Communities. Biological and Environmental Sciences. *Journal for the Tropics.* 12(1):670-674.

Rist, L., Campbell, B.M. and Frost, P., 2013. Adaptive management: where are we now?. *Environmental Conservation*, *40*(01), pp.5-18.

River Restoration Centre. 1999. The effects of river restoration on the R. Cole and R.Skerne demonstration sites. Final Report. The River Restoration Centre,13pp

River Restoration Centre. 2008. Demonstration Projects, River Quaggy, Chinbrook Meadows. Available

from:http://www.therrc.co.uk/case_studies/chinbrook_meadows.pdf. Accessed 24/06/2014.
Robinson, M. 1990 Impact of improved land drainage on river flows Institute of Hydrology, Report 113, Oxon, UK. ISBN 0948540249.
Rogers, P. and Hall, A.W., 2003. Effective water governance (Vol. 7). Global water partnership.
Ross, H. and Berkes, F., 2014. Research approaches for understanding, enhancing, and monitoring community resilience. Society & Natural Resources, 27 (8), pp.787-804.
Rowe, G., Frewer, L., 2000. Public participation methods: a framework for evaluation in science. *Technology and Human Values* 25, 3–29.
Rydin, Y., Pennington, M., 2000, 'Public participation and local environmental planning: the collective action problem and the potential of social capital', Local Environment 5(2), 153–169.
Sabastiaan,V. H., Zevenbergen, C., Ashely, R., Rijke, J. 2011. Learning and Action Alliances for the integration of flood risk management into urban planning: a new framework from empirical evidence from The Netherlands. *Environmental Science & Policy* 14(5). 543-554.
Sackey, A.N.A., 2007. Assessment of forest management practices in Ghana—a case study of some forest districts in Ghana. *Int Manag Resour Environ J*, *1*(2).
Samuels, P., F. Klijn, and J. Dijkmann. 2006. An analysis of the current practice of policies on river floods risk management in different countries. *Irrigation and Drainage* 55: S141-S150. HTTP:// dx.doi.org/10.1002/ird.257
Sandercock, L. (1998) Towards Cosmopolis (Chichester: Wiley)
Saunders, M., Lewis, P., Thornhill, A. 2012. Research Methods for Business Students, 6th edition, Pearson.
Sayers, P., L.i, Y., Galloway, G., Penning-Rowsell, E., Shen, F., Wen, K., Chen, Y., Le Quesne, T. 2013. Flood Risk Management: A Strategic Approach. Paris, UNESCO.
SBSTA, 2005. Decision 2/CP.11 A five-year programme of work of the Subsidiary Body for Scientific and Technological Advice on impacts, vulnerability and adaptation to climate change. FCCC/CP/2005/5/Add.1
Schanze J. 2006. The theoretical and methodological basis of flood risk management in Europe. In: Schanze J, Zeman, E & Marsalek, J (eds.), Flood risk management: Hazards, vulnerability, mitigation measures. Springer NATO Series on Advances in Sciences.
Schindler, S., Sebesvari, Z., Damm, C., Euller, K., Mauerhofer, V., Schneidergruber, A., Biró, M., Essl, F., Kanka, R., Lauwaars, S.G. and Schulz-Zunkel, C., 2014. Multifunctionality of floodplain landscapes: relating management options to ecosystem services. *Landscape Ecology*, *29* (2), pp.229-244.
Schneider, S.: 2002, 'Can we Estimate the Likelihood of Climatic Changes at 2100?', *Climate Change* **52**, 441–451.
Scoones, I. (1999). New Ecology and the Social Science: What Prospects for a Fruitful Engagement? *Annual Review of Anthropology* 28(1): 479-507.
Scott, M., White, I., Kuhlicke, C., Steinfuhrer, A., Sultana, P., Thompson, P. 2013. Living with flood risk/The more we know, the more we know we don't know: Reflections on a decade of planning, flood risk management

and false precision/Searching for resilience or building social capacities for flood risks? /Participatory floodplain management: Lessons from Bangladesh/Planning and retrofitting for floods: Insights from Australia/Neighbourhood design considerations in flood risk management/Flood risk management – Challenges to the effective implementation of a paradigm shift. *Planning Theory & Practice*. (14) 1.pp:103-106.

Scottish Executive. 2005. Final report of the National Technical Advisory Group on Flooding Scottish Executive, Edinburgh. Available online from http://www.scotland.gov.uk/Topics/Environment/Water/Flooding/16919/ntgfinalreport

Seaman, C. 1999. Qualitative methods in empirical studies of software engineering. *IEEE Trans Softw Eng* 25(4): 557-572.

Selsky, J. W., Parker, B. 2010. Platforms for Cross-Sector Social Partnerships: Prospective Sensemaking Devices for Social Benefit. *Journal of Business Ethics*.94:21-37.

SEPA, 2011. Allan Water Natural Flood Management Techniques and Scoping Study. Documents: ROI Version: 2.

SEPA, 2015. Natural Flood Management Handbook. ISBN number: 978-0-85759-024-4

Sherman, H. M., Ford, J. 2014. Stakeholder engagement in adaptation interventions: an evaluation of projects in developing nations. *Climate Policy*. Vol.14 (3).

Singh, H. S. 2003. Vulnerability and adaptability of tidal forests in response to climate change in India. *Indian Forester* .129:749–756.

Siriwardena, L., Finlayson, B.L., McMahon T.A. 2006. The impact of land use change on catchment hydrology in large catchments: The Comet River, Central Queensland, *Australia. J. Hydrology* 326, 199-214

Sloan, P. 2009. Redefining Stakeholder Engagement: From Control to Collaboration. *Journal of Corporate Citizenship*, (36), 25-40.

Smit, B., Pilifodova, O., Burton, I., Challenger, B., Huq, S., Klein, R.J.T., Yohe, G., Adger, N.W., Downing, T.E., Harvey, E., Kane, S., Parry, M., Skinner, M., Smith, J., Wandel, J., Patwardhan, A., Soussana, J.-F., 2001, 'Adaptation to climate change in the context of sustainable development and equity', in: J. McCarthy, O.S. Canziani, N. Leary, D. Dokken, K. White (eds), Climate Change 2001: Impacts, Adaptation and Vulnerability, Cambridge University Press, Cambridge, UK.

Smith MS, Horrocks L, Harvey A., Hamilton C .2011. Rethinking adaptation for a 4 degrees C world. *Philos Trans R Soc Math Phys Eng Sci* 369:196–216.

Smith, J.L.2008. A critical appreciation of the "bottom-up" approach to sustainable water management: embracing complexity rather than desirability. Local Environment: *The International Journal of Justice and Sustainability*.13 (4).

Sneddon, C., Howarth, R. B., & Norgaard, R. B. 2006. Sustainable development in a post-Brundtland world. *Ecological Economics*, 57(2), 253-268.

Spey Fishery board, 2015. Spey catchment [ONLINE]. Available at: http://www.speyfisheryboard.com/catchment-characteristics/ [Accessed 17 February 15].

Spray, C. Ball, T., Josselin, R. 2009. Bridging the Water Law, Policy, Science Interface: Flood Risk Management in Scotland. *Journal of Water Law*, 20(2-3). Pp: 165-174.

Stake, R. 1995. The Art of Case Study Research, Thousand Oaks, CA: Sage Publications

Stake, R.E. 2000 (2nd ed.), 'Case Studies' in N.K. Denzin and Y.S. Lincoln (eds.), Handbook of Qualitative Research, Thousand Oaks: Sage Publications

Stead, J.G., Stead. E. 2000. Eco-Enterprise Strategy: Standing for Sustainability, *Journal of Business Ethics* .24.PP: 313–329.

Strauss, A. L., Corbin, J. 1998. Basics of qualitative research: Techniques and procedures for developing grounded theory (2nd) Thousand Oaks, CA: Sage.

Stringer, L.C., Reed, M.S., Dougill, A.J., Rokitzki, M., Seely, M., 2007. Enhancing participation in the implementation of the United Nations Convention to Combat Desertification. *Natural Resources Forum* 31, 198–211.

Susskind, L., Camacho, A.E. and Schenk, T., 2012. A critical assessment of collaborative adaptive management in practice. *Journal of Applied Ecology*, *49* (1), pp.47-51.

Talen, E. (2000) The problem with the community in planning, Journal of Planning Literature, 15(2), pp. 171 – 183.

Tatenhove, V., Jan P. M. & Leroy, Pieter. 2003. Environment and Participation in a Context of Political Modernisation. *Environmental Values*. 12 (2):155-174.

Taylor-Powell, E. and Renner, M., 2003. Analysing qualitative data

Thomas, H. and Nisbet, T.R. 2006. An assessment of the impact of floodplain woodland on flood flows. *Water and Environment Journal* 21 (2) 114-126.

Thomas, J. and Harden, A., 2008. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC medical research methodology*, *8*(1), p.1.

Thomas, J., 1993. Public involvement and governmental effectiveness: a decision-making model for public managers. *Administration and Society* 24, 444–469.

Tingsanchali, T. 2012. Urban Flood Disaster management. *Procedia Engineering*, 32, pp. 25-37.

Tippett, J., Handley, J.F., Ravetz, J., 2007. Meeting the challenges of sustainable development – A conceptual appraisal of a new methodology for participatory ecological planning. *Progress in Planning*. 67, 9–98.

Tomás, A., 2003. A human rights approach to development: a primer for development practitioners. *Prepared for a training course on a human rights approach to development organised by UNDP Nepal (August 2003)*.

Trenberth, K.E., Fasullo, J.T. and Shepherd, T.G., 2015. Attribution of climate extreme events. *Nature Climate Change*.

Tschakert, P. and Dietrich, K.A., 2010. Anticipatory learning for climate changes adaptation and resilience. *Ecology and Society*, *15*(2), p.11.

Tschakert, P. and Shaffer, L.J., 2014. Ingredients for Social-Ecological Resilience, Poverty Traps, and Adaptive Social Protection in Semi-Arid Africa. *In Social-Ecological Systems in Transition* (pp. 139-156). Springer Japan.

Tukker, A., 2013. Knowledge collaboration and learning by aligning global sustainability programs: reflections in the context of Rio+ 20. *Journal of Cleaner Production*, 48, pp.272-279.

Turner, B.L., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Hovelsrud-Broda, G.K., Kasperson, J.X., Kasperson, R.E., Luers, A. and Martello, M.L., 2003. Illustrating the coupled human–environment system for vulnerability analysis: three case studies. *Proceedings of the National Academy of Sciences*, *100*(14), pp.8080-8085.

Tweed Forum. 2011. Eddleston Catchment. Available Online from http://www.tweedforum.org/publications/forum_gis (Accessed on 5/06/2015)

UBDA, 2012. Annual Wettest Month, 1970-2013.

Umar, H. M., Nyameh, J., Jauro, J. 2014. Agricultural Management Strategy on Food Security in Taraba State. *Journal of Biology, Agriculture and Healthcare,* 4(8).

UN Department of Economic and Social Affairs (17 September 2014, New York) General Assembly adopts a resolution on SDGs Report, Available at http://www.un.org/en/development/desa/news/sustainable/sdgs-post2015.html (Accessed: 10/05/2015).

UNCED, 1992. Nations of the Earth Report, vols. I–III, Geneva: United Nations

UNFCCC, 1992. United Nations Framework Convention on Climate Change, United Nations

UNFCCC, 2007. Background Paper – Impacts, Vulnerability and Adaptation to Climate Change in Asia. UNFCCC Secretariat. Bonn, Germany. Available at: http://unfccc.int/files/adaptation/methodologies_for/vulnerability_and_adaptation/application/pdf/unfc cc_asian_workshop_background_paper.pdf Accessed on 22/08/2014

United Nations, 2010. *Natural hazards, unnatural disasters: the economics of effective prevention*. The World Bank.

van der Linden, S., 2015. The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, pp.112-124.

Van Langenhove, G., 2012. Towards a post-2015 framework for disaster risk reduction. Available at: http://www.preventionweb.net/posthfa/dialogue/ discussion/21/changes-in-severity-and-frequency-ofextreme-weather-and-climate-events-and-consequentchanges-in-behaviour/.

Van Wesenbeeck, B.K., van der Meulen, M.D., Pesch, C., de Vriend, H. and de Vries, M.B., 2016. Nature-Based Approaches in Coastal Flood Risk Management: Physical Restrictions and Engineering Challenges. In *Ecosystem-Based Disaster Risk Reduction and Adaptation to Practice* (pp. 181-198). Springer International Publishing.

Vygotsky L. 1986. Thought and Language. Transl. and ed. A. Kozulin. Cambridge, MA: The MIT Press.

Wahab, B. and Ojolowo, S.K. 2012 Application of Indigenous Knowledge to Flood Prevention and Management. *African Journal of Sustainable Development*, *2*(1), pp.79-116.

Walker, B., S. Carpenter, J. Anderies, N. Abel, G. S. Cumming, M. Janssen, L. Lebel, J. Norberg, G. D. Peterson, and R. Pritchard. 2002. Resilience management in social–ecological systems: a working hypothesis for a participatory approach. Conservation Ecology 6(1): 14. [online] URL: http://www.consecol.org/vol6/iss1/art14/.

Wals, A. E. J., editor. 2007. Social learning towards a sustainable world. Wageningen Academic Publishers, Wageningen, The Netherlands

Ward, P. J., Pauw, W. P., Van Buuren, M. W., & Marfai, M. A. 2013. Governance of flood risk management in a time of climate change: the cases of Jakarta and Rotterdam. *Environmental Politics*, 22(3), 518-536.

Warner, M.,1997. Consensus' participation: an example for protected areas planning. *Public Administration and Development*. 17, 413–432.

Webler, T., 1999. The craft and theory of public participation: a dialectical process. *Journal of Risk Research* 2, 55–71.

Wehn, U., Rusca, M., Evers, J., Lanfranchi, V., 2015. Participation in flood risk management and the potential of citizen observatories: A governance analysis, *Environmental Science & Policy*, Volume 48, PP: 225-236.

Weingart, P., Engels, A. Pansegrau, P. 2000. The risk of communication: Discourse on climate change in science, politics and the mass media. *Public Understanding of Science. 9(3), pp: 261-283.*

Werlen, B. ed., 2015. *Global Sustainability, Cultural Perspectives and Challenges for Transdisciplinary Integrated Research*. Springer.

Werritty, A. 2006. Sustainable flood management: oxymoron or new paradigm? *Area* (38) 16–23.

Werritty, A., Spray, C., Ball, T., Bonell, M., Rouillard, J., MacDonald, A., Comins, L. and Richardson, R., 2010, July. Integrated catchment management: from rhetoric to reality in a Scottish HELP basin. In *Bhs Third International Symposium, Managing Consequences of a Changing Global Environment, Newcastle 2010*. British Hydrological Society.

Wesselink, A., Paavola, J., Fritsch, O. and Renn, O., 2011. Rationales for public participation in environmental policy and governance: practitioners' perspectives. *Environment and Planning A*, *43*(11), pp.2688-2704.

Wilkinson, M., et al. 2011 Evaluating multipurpose soft engineered mitigation measures in the Belford Burn catchment, Northumberland, UK Catchment Science Workshop, Dublin.

Wilkinson, M., Quinn, P., Jonczyk, J., Nicholson, A., Owen, G., Barber, N. 2011. Evaluating multipurpose soft engineered mitigation measures in the Belford Burn catchment, Northumberland, UK Catchment Science Workshop, Dublin.

Willows, R., Connell, R. (eds), 2003, 'Climate Adaptation: Risk, Uncertainty and Decision-Making', UKCIP Technical Report, UK Climate Impacts Programme, Oxford, UK.

Wohl, E., P., Angermeier, L., Bledsoe, B. Kondolf, G.M, MacDonnell, L., Merritt, D. M., Palmer, M.A., Poff, N. L., Tarboton, D. 2005. *River restoration* Water Resour. Res., 41.

Wondolleck, J. M. & Yaffee, S. L. 2000 Making Collaboration Work: Lessons from Innovation in Natural Resource Management (Washington DC: Island Press).

Woodley, D. M. 2013. Re-configuring Local Governance for Community Resilience: Social learning for flood adaptation under a changing climate - A Literature Review. Report commissioned by Exeter University Academic Consultant

Wuni, M.T., 2008. *Inter-Agency Coordination for Effective Humanitarian Relief Operations: The Case of the 2007 Floods In Northern Ghana*. Erasmus University.

WWF, 2002. Background briefing paper; Managing Floods in Europe: The Answers Already Exist. More intelligent river basin management using wetlands can alleviate future flooding events. http://www.assets.panda.org/downloads/managingfloodingbriefingpaper.pdf

Yin, R. K. 2011. Applications of Case Study Research. Sage Publications

Yin, R.K. 2003. (3rd ed.), Case Study Research: Design and Methods, London: Sage Publications

Yin, R.K. 2009. Case study research. Design and methods. 4. ed. Thousand Oaks, California

Yin, R.K., 2013. *Case study research: Design and methods*. Sage publications.

Yin, Robert K. (2003a). *Case study research, design and methods* (3rd ed., vol. 5). Thousand Oaks: Sage.

Young, S. 2007. Developing a Case Study Methodology: Comparing Best Practice Cases in Creating an Environment Conducive to Development Benefits, Growth and Investment. United Nations Conference on Trade and Development Geneva.

Younge, A., Fowkes, S., 2003. The cape action plan for the environment: an overview of an Ecoregional planning process. *Biological Conservation* 112, 15–28.

Zasada, I. 2011. Multifunctional peri-urban agriculture – A review of societal demands and the provision of goods and services by farming. Land Use Policy, 28(4), pp.639-648.

Zevenbergen, Chris, Sebastiaan van Herk, Jeroen Rijke, Pavel Kabat, Pieter Bloemen, Richard Ashley, Andrew Speers, Berry Gersonius, and William Veerbeek. 2013. Taming global flood disasters. Lessons learned from Dutch experience. *Natural Hazards*, 65(3), 1217-1225.

Zhang, X. and Zwiers, F., 2016. Observed and projected changes in temperature and precipitation extremes. *Dynamics and Predictability of Large-Scale, High-Impact Weather and Climate Events*, *2*, p.47.

Ziervogel, G, *et al*. 2014. Climate change impacts and adaptation in South Africa. *Wiley Interdisciplinary Climate Change* 5:605-620. Doi:10.1002/wcc.295.

Appendix A: Abstract of Paper Presented at Conference

Paper presented at the IWA 7th International YWP Conference held in Taipei on 7th- 11th December 2014.

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Community Environmental Stewardship: A mechanism for Natural Flood Management delivery.

Natural Flood Management (NFM) as a component of Sustainable flood management seeks to explore avenues to work with natural hydrological and morphological processes to manage the source and pathways of flood waters.

This paper presents an approach aimed at enhancing the role of local stakeholders in decision-making and the development of Natural Flood Management strategies within River Catchments using Multi-Criteria Analysis (MCA) as a decision support tool. The concept is based on an evaluation of eight (8) NFM pilot case studies in Scotland and England hosted between the year 2000 and 2013. These case studies catchments include Tarland, Allan Water, Eddleston Water, Spey catchment initiative (Feshie and Dulnain), Belford, Derwent and Upper Clyde. The objective was to identify the key issues relating to the establishment and delivery of NFM strategies and support the wider adoption of the approach by detailing lessons learnt from the case studies.

The findings provided information on catchment –level partnerships and inform the development of a framework which identified key factors essential to improve understanding of the opportunities and barriers to involving communities in catchment based working. The size of the catchments and the complexity of the issues faced, shaped the context in which the pilot studies developed. However, the evaluation was not only in terms of the efficacy of the environmental improvements but also by the extent to which stakeholder engagement and inter –agency working have been effective and the extent to which the learning outcomes have been identified or achieved. All the studies were defined by hydrological boundaries and the catchment based approach allowed the integration of local issues and consideration of other administrative interaction. The Source-Pathway-Receptor framework was used in three case studies (Eddleston, Tarland and Belford). All eight had considered comprehensive approaches, incorporated ecosystems –restoration programs and WFD issues. Driving forces and objectives addressed water quality concerns, economic development, recreational opportunities and flood mitigation.

Seven out the eight initiatives engaged with the public in some way. Five of the eight study catchments (Eddleston, Belford, Tarlard, Derwent and Spey) had pre-existing partnership platforms for the management of catchment issues. From the evaluations, it was identified that this factor, was a key variable in the collaboration process, and delivery of the projects. It also enhanced the acceptability and collaboration processes for NFM application within these catchments.

The development of appropriate long-term flood management strategies is a continuous challenge. The gradual shift from intervention based methods to an approach that promotes community involvement in their own development makes it essential to review the principles and relationship among the local community and the outside experts. Unquestionably, the evaluations of the measures taken, often on the initiative of the authorities and regulatory bodies have highlighted issues concerning the maintenance and sustainability of the measures taken in the future. The studies have identified that a key element for success is the continued engagement of a wide range of stakeholders and the public in catchment planning. This can be achieved through the strengthening of existing partnerships, along with well-established principles of public participation.

Appendix B: Abstracts of Paper Presented in Conference

Paper presented at the 4th Future Connection 2015. Sustainability Research in Action held at Edinburgh Centre for Carbon Innovation on the 25th -26th June 2015

Ndenyangnde Ripiye

Abertay University. Kydd Building, 40 Bell Street. UK. DD1 1HG.

Natural Flood Management (NFM) applications: the influence of partnership platforms (Environmental Sustainability)

Support of Natural Flood Management (NFM) is growing at the local, national and international levels in line with sustainability aspirations. Public participation in EU Directives, such as the Water Framework Directives and the Flood Risk Management (Scotland) Act 2009, require collaboration with all catchment stakeholders. Current trends are progressively moving towards a collaborative learning approach where stakeholder participation is encouraged as one of the indicators of sustainable development; embracing a diversity of knowledge and values underpinned by a philosophy of empowerment, equity, trust and learning. The major challenge herein is in the understanding, management of growing complexity of socio- economic reality and its immediate relevance for sustainable development. The aim of this study is to explore the complexities of NFM processes and local stakeholder influences within partnership platforms in eight (8) NFM pilot case studies in Scotland and England. The results of the research suggest that if NFM projects are to burgeon, future strategies must develop facilitation methodologies for problem-solving among multiple stakeholders which consider economic, social aspects and local exigencies

Appendix C: Interview Questions (Community Leaders)

Local community heads.

Question 1: *How long have you lived/worked in the area (study area) and what is predominant land use type and activities?*

Question 2*: How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?*

Question 3: *Which event was the most severe and how were you affected. In your opinion, is the trend increasing or decreasing*?

Question 4: *What were the extent of damages and monetary implications for the community*?

Question 5: *What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?*

Question 6: *Has there been any local indigenous efforts to discuss/implement mitigative interventions?*

Question 7: *Was there any government initiative for flood mitigation in your local area*?

Question 8: *If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area*?

Question 9: *Was the local community involved in any stage of consultation and planning?*

Question 10: *What are your concerns about the socio-economic effects of flooding in the area?*

Question 11: *In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?*

Question 12: *How do you feel you can bring about the desired change in your area as far as flood protection is concerned?*

Question 13: *How would you like to be involved in flood mitigation decision making process? If so, to what extent?*

Appendix D: Interviews Questions for Government Agency (GA)

***Question 1**: What government agency do you represent?*

***Question 2**: Under the current legal and policy requirements, what are your agency responsibilities in flood mitigation?*

***Question 3**: In the previous flooding events, what was your agency's response?*

***Question 4**: Does your agency work alone or do you partner with other government agencies for flood mitigation?*

***Question 5**: Do these partnerships involve local leaders, community-based organisations, civil society groups, the media and the academic communities?*

***Question 6:** What are your agencies strategies for flood risk management and how does this plan integrate future uncertainty and climate change?*

***Question 7**: How has this improved the planning and implementation of the flood mitigation in Taraba state?*

***Question 8:** Has there been any effort to involve the vulnerable communities in the planning process?*

***Question 9**: A recent report by NEMA identified vulnerable communities and stressed the importance of flood risk perception what efforts has your agency made towards public awareness and education?*

***Question 10**: What are the current challenges your agency faces in the implementation of flood management plans and how do you hope to address these challenges?*

***Question 11:** In your opinion, what is your general view on the current system and how can it be improved in terms of proactive approaches, adaptive management, flood resilience and sustainability?*

Appendix E: Interview Protocol: Community Leaders

Introduction

You have been selected to speak to us today because you are identified as a community leader within ---------- Local Government Area. According to SEMA reports, your community was affected by 2005, 2009 and 2012 flood incidents. We believe you are in a position to share your experience about flood impacts, community vulnerability, local adaptation strategies and community involvement in flood mitigation. My research project as a whole focuses on the current management strategies, government responses and on the improvement of learning for better management. The study does not represent any government intervention and it does not aim to evaluate your techniques or experience nor does it involve any monetary implication for you. Rather we are trying to determine current practices in the area and identify key issues that would make a difference in flood management.

Interviewee Background

How long have you been in your present position as leader of this community?

A. Flood history, Community vulnerability & Environmental awareness

1. *How long have you lived/worked in the area (study area) and what are predominant land use type and activities?*

Probes:

- What are the social and economic activities in the community?
- Briefly, describe your role as community leader and how it relates to flood management and coordination?

2. *How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?*

Probes:

- How did the community respond to the events?

3. *What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?*

Probes:

- Do you believe the location of the village; make it more prone to flooding?

B. Socio- Economic impacts

4. *Which event was the most severe and how were you affected? In your opinion, is the trend increasing or decreasing?*

Probes:

- What is the basis for your answer i.e. loss of living, property?
- Why do you think it is increasing or decreasing?

5. *What were the extent of damages and monetary implications for the community?*

Probes:

- How was the community affected? (Property loss, lives)

6. W*hat are your concerns about the socio-economic effects of flooding in the area?*

Probes:

- What are the major issues affecting communities livelihoods?

C. Adaptation strategies and human management

7. *Has there been any local indigenous effort to discuss/implement mitigative interventions?*

Probes:

- What strategies have the community applied for mitigation?
- How effective was it?

8. *Was there any government initiative for flood mitigation in your local area?*

Probes:

- If yes, how would you assess the intervention?

9. *In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?*

Probe:

- Is this currently applied?
- How effective is this and how can this be improved?

D. Community involvement in vulnerability reduction

10. *If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?*

Probe:

- Was the community given an opportunity to contribute?

11. *Was the local community involved in any stage of consultation and planning?*
12. *How do you feel you can bring about the desired change in your area as far as flood protection is concerned?*
13. *How would you like to be involved in flood mitigation decision making process? If so, to what extent?*

Appendix F: Documents and data analysed

	Documents	Data Analysed
1	Annual Wettest Month, 1970- 2013. (UBDA,2012)	Rainfall and precipitation data.
2	UBRDA Met Station (UBDA, 2012)	Monthly mean maximum Temperature.
3	Managing Transboundary disaster: Socio-economic impacts of Lake Nyos collapse and implications for Disaster Monitoring (Dr J.O. Akinyede)	Impacts of flooding and environmental damage in Taraba state
4	Report on the need to procure and install early warning systems (EMS) in some parts of Taraba state that are likely to be affected by the Lake Nyos disaster. (TEPA, 2010) .	Government efforts in disaster Preparedness
5	Lake Nyos Eruption Threat (Ministry of Environment and Urban Development, 2012)	Potential impacts in Taraba states
6	Mitigating Lake Nyos flood Threat (DG NEMA, 2009).	Flood preparedness
7	Early Warning Message for 2012 (NEMA, 2012)	Disaster management implications for the 2012 NIMET forecast
8	31st August 2009 Flood Disaster in Jalingo, the Taraba state capital. (State Ministry for Environment, 2009)	Jalingo Flood assessment report 2009
9	Technical Committee Report on the flood Disaster in Jalingo (Ministry of Environment and Urban Development & TEPA, 2009)	Jalingo Flood assessment report 2009
10	Report of the six-man committee on the assessment of damage caused by floods of August 2011. (Ministry of Environment & Urban Development / TEPA, 2011)	Flood assessment reports
11	Environmental impact assessment in Nigeria: regulatory background and procedural framework (UNEP EIA Training Resource Manual)	Nigerian environmental management procedures
12	National Disaster Framework	Nigerian regulatory disaster framework
13	Review of NESREA ACT 2007 and Regulations 2009-2011(Ladan, 2012)	Country Legislation

14	The Taraba state emergency management agency (Establishment) Law, 2008. Law No.6 of 2008.	Laws establishing SEMA
15	Africa Climate Change : 1900-2100	African Climate change Scenario
16	Land Degradation and sustainable development in Northern Nigeria (B.D.Tarfa, 2012)	Societal pressures on land and sustainable land management
17	Developing Priorities for flood risk reduction, mitigation and water resource management in the Benue river Basin (Alayande & Waheed, 2014)	Risk reduction recommendations
18	Water resource development in the Benue valley; current status, opportunities and challenges. : status report presented at stakeholders workshop on flood risk reduction and sustainable water resource development and management	River-based projects
19	Nigeria: Enhancing resilience to natural disaster and climate change. Policy note. 2014	Government responses and key outstanding challenges to resilience planning
20	Nigeria: post –Disaster need assessment, 2012 floods. (FGN, 2013)	
21	Towards Climate-resilient Development in Nigeria. (World Bank, 2013).	National Adaptation strategy
22	"Low-Carbon Development: opportunities for Nigeria" Directions in Development. (World Bank, 2013).	Developmental projections
23	Floods figures data and update at National level	National numbers of affected/displaced by state
24	Flood reports 2012	Flood impacts and affected communities
25	Report on the flood disaster in Taraba by state Emergency management agency (SEMA, 2012)	Flood disaster profile in Taraba state
26	Assessment reports on the flood disaster in Jalingo, Lau, Ardo-kola and Yorro LGA (SEMA, 2012)	Flood impacts and affected communities
27	Minutes of 1st stakeholder meeting 2012 (August 2012)	Assessment of flood impacts
28	Minutes of 2nd stakeholder meeting 2012 (September 2012).	Assessment of flood impacts
29	Minutes of 3rd stakeholder meeting 2013(March 2013)	Assessment of flood impacts

Appendix G: Interview Dates

	Community Leaders (CL)	Interview dates	Government Agency (GA)	Interview dates
	Jalingo LGA			
1	Nukkai	30/12/2013	Lau LGA	GA1/05/02/2014
2	Mayo -Dassa	30/12/2013	Jalingo LGA	GA2/06/02/2014
3	ATC	30/12/2013	Ardo kola LGA	GA3/06/02/2014
4	Majindadi	3/01/2014	TSEMA (SEMA)	GA4/10/02/2014
5	Sarkin Dawaki	3/01/2014	Min Env	GA5/07/02/2014
6	Angwan Yandang	7/01/2014	Min Health	GA6/10/02/2014
7	Kurnayel	7/01/2014	MWRRD	GA7/07/02/2014
8	Angwan Majidadi ward	10/01/2014	Min Inf	GA8/11/02/2014
9	Angwan Tudunwada	10/01/2014		
10	Gongon Wakili Abba	10/01/2014		
11	Angwan Korofi	14/01/2014		
12	Turaki Ward	14/01/2014		
13	Magami (i)	16/01/2014		
14	Magami (II)	16/01/2014		
15	Mayo gwoi	21/01/2014		
16	Nassarawo	21/01/2014		
17	Nyabun Kaka	22/01/2014		
18	Malam Joda	22/01/2014		
19	Jeka dafari	22/01/2014		
	Lau LGA (CL)			
20	Lau A Ward	27/01/2014		
21	Shomo Sarki	27/01/2014		
22	Garin Audi	28/01/2014		
23	Bandawa Kuka	28/01/2014		
24	Angwan Buba Bachama	30/01/2014		
25	Kunini	31/01/2014		
26	Garni Mashi	30/01/2014		
	Ardo Kola LGA (CL)			
27	Mayo -Renewo	03/02/2014		
28	Murbai	03/02/2014		
29	Angwan Sojiri	03/02/2014		
30	Jauro Sobai	04/02/2014		
31	Kofai	04/02/2014		
32	Kurnayel	04/02/2014		

Appendix H: Interview Reponses (Excerpt sample)

INTERVIEWS RESPONSES (GOVERNMENT AGENCIES)

Ministry of Environment (GA5/ 07/02/2014)

Q1. What government agency do you represent?

I represent the Ministry of Environment and Urban Development, Taraba state

Q2 Under current legal and policy requirements, what are the agency's responsibilities in flood mitigation?

On the reduction of flood problems or mitigation, this Ministry on one of its duties; survey; design and provide Bills of Engineering measurements for storm water drainages to dissipate flooding on affected perennial areas into receiving low- land/water bodies

Q3 In the previous flooding events, what was your agency's response?

Based on the geographical location of Taraba state and indeed the state capital-Jalingo which is located between hills and mountain ranges, the state is in danger of repeated cases of flooding. As seen in the floods of September 2005, September 2008 and August 2009 examples. The ministry, on its responsibilities,_identified critical areas, design and constructed stormwater drainages e.t.c. the Mayo-Gwoi, the Boboji, the Makarfi and other storm water drainages. This effort is a continuous process.

Q4 Does your agency work alone or do you partner with other government agencies for flood mitigation?

The state government finances the projects on contract bases and supervise by the Ministry.

Q5 Does these partnerships involve local leaders, community-based organisations, civil society groups, the media and the academic communities?

As specified on Q4 above, the Ministry plays/ announces jingles for local communities to assist in a government effort to reduce flood in their areas by cooperating with any works to be executed by the government.

Q6 What are your agencies strategies for flood risk management and how does this plan integrate future uncertainty and climate change?

The Ministry on its strategies on future uncertainty and climate change in November 2011 went out in a team, surveyed critically affected areas in the state and compiled reports including financial implications to the Federal Ministry of Environment on Ecological funds for Taraba state

Q7 How has this improved the planning and implementation of the flood mitigation in Taraba state?

The above approach by the Ministry has indeed improved the planning as expected by the state through the Federal Ministry of Environment.

Q8 Has there been any effort to involve the vulnerable communities in the planning process?

On the above-mentioned planning process, the team asked the communities on their plight and their needs that the government can assist on their vulnerable conditions, (Records available).

Q9 A recent report by NEMA identified vulnerable communities and stressed the importance of flood risk perception what efforts has your agency made towards public awareness and education?

Response from SEMA.

Q10 What are the current challenges your agency faces in the implementation of flood management plans and how do you hope to address these challenges?

Implementation involves financing through the state government and Federal government. The Ministry has been on the follow-up.

Q11 In your opinion, what is your general view on the current system and how can it be improved in terms of proactive approaches, adaptive management, flood resilience and sustainability?

Yearly budgetary provisions must be provided and strictly implemented for disasters like a flood which is not man-made.

State Emergency Management Agency (SEMA) (GA4, 10/02/2014)

Q1 what government agency do you represent?

Taraba State Management Agency (SEMA)

Q2 Under the current legal and policy requirements, what are your agency responsibilities in flood mitigation?

To create awareness, Rescue victims of the flood, Relocation of victims, Rehabilitation and provision of relief materials, Early warning alerts.

To sensitise the populace on the need to adhere to building codes, land use Acts e.t.c.

Q3 In the previous flooding events, what was your agency's response?

Search and rescue and we provided relief materials to communities affected

Relocation of victims, establishment of IDP camps,

Evacuation of victims.

Q4 Does your agency work alone or do you partner with other government agencies for flood mitigation?

Partnership with government agencies, the private sector, NGO's, CBO's, FBO's. e.t.c.

Q5 Does these partnerships involve local leaders, community-based organisations, civil society groups, the media and the academic communities?

Yes, media alliance, UNICEF

Q6 What are your agencies strategies for flood risk management and how does this plan integrate future uncertainty and climate change?

Flood mapping, flood risk assessment, watershed management, clearing of drainages, tree planting.

Q7 How has this improved the planning and implementation of the flood mitigation in Taraba state?

I cannot evaluate that at the moment

Q8 Has there been any effort to involve the vulnerable communities in the planning process?

Yes, especially in the area of camp management in identifying suitable locations and decisions that border the internally displaced persons. (IDPs).

Q9 A recent report by NEMA identified vulnerable communities and stressed the importance of flood risk perception what efforts has your agency made towards public awareness and education?

Advocacy visits to relevant stakeholders.

Sensitization and training of volunteers.

The signing of a memorandum of understanding (MOU) with other stakeholders for prompt response in an emergency situation.

Coordination meeting of partners.

Q10 what are the current challenges your agency faces in the implementation of flood management plans and how do you hope to address these challenges?

Challenges are enormous.

Socio-cultural belief and values attached to locations.

Insufficient funds and logistic

The dearth of personnel.

Poor cooperation from Local authorities (LGAs).

Population growth density.

Way forward

The need for continuous sensitization and awareness creation especially the communities living in the flood plain areas.

The government, private sectors and well to do individuals to support this course through the provision of funds, vehicles, fuel. e.t.c.

More personnel be recruited who have knowledge and skills in disaster management

Local Government Areas should cooperate and collaborate to secure the plight of the communities

Control birth rate.

Q 11 In your opinion, what is your general view on the current system and how can it be improved in terms of proactive approaches, adaptive management, flood resilience and sustainability?

The current system of flood management is fair but more attention should be focused on a community –driven participation with government support, that is to incorporate disaster risk reduction into development efforts and effort should also be made to integrate scientific study with the traditional system, this will strike a balance.

Appendix I: Interview Response (Excerpt sample). CL

A part of community leader interviews in Taraba state (Lau, Jalingo, and Ardo-kola). All interviews took place in a 10 week period and were conducted at the participant homes and localities. An average of 3 interviews was conducted in a day with an average duration of 35 mins each.

PARTICIPANT 3

ATC (Jalingo LGA) CL3, 30/12/2013

The research met the participant at his home at 3 pm on the 30/12/2013. The participant was quick to acknowledge the local government notice of our research visits. After the brief introductions, the interview began.

How long have you lived/worked in the area (study area) and what are predominant land use type and activities?

I was born here. Most of the communities here employed at the state university but we also engage in small-scale farming

How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?

I can say three

Which event was the most severe and how were you affected? In your opinion, is the trend increasing or decreasing?

It was the 2005 floods, are you an indigene of Taraba? Then you should know we were totally cut off when the bridge collapsed.

What were the extent of damages and monetary implications for the community?

The event crippled the whole local government areas for weeks. The loss of farm produce, some buildings collapsed and about 200 people lost their lives.

What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?

Excess rains and changing the climate. This climate change thing is becoming very evident as you can see, it's 3.30 pm, right in the middle of the harmattan season and it's still very hot.

Has there been any local indigenous effort to discuss/implement mitigative interventions?

No at all only individual efforts to protect their homes

Was there any government initiative for flood mitigation in your local area?

Yes the rebuilding of the bridge after it collapsed

If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?

Nobody told us anything

Was the local community involved in any stage of consultation and planning?

N/A

What are your concerns about the socio-economic effects of flooding in the area?

We have a college and university and some important buildings which are at risk of being flooded. Some of us work there and also do a little farming. Even if it is for this building alone, more needs to be done

In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?

There is a serious need to improve the drainage systems around here and control indiscriminate building

How do you feel you can bring about the desired change in your area as far as flood protection is concerned?

That is a difficult question, if the government asked us to contribute, am not sure we can help. I am not sure

How would you like to be involved in flood mitigation decision making process? If so, to what extent?

I am not sure how I can help but yes if the government decides to, we as a community are willing

PARTICIPANT 4

Majindadi (1) (Jalingo LGA) CL4, 3/01/2014

The participant was interviewed at 9.30 am on the 3/1/2014.

How long have you lived/worked in the area (study area) and what are predominant land use type and activities?

34 years, we are mainly farmers; we grow vegetables all year round because of our proximity to the river.

How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?

4 flooding events

Which event was the most severe and how were you affected? In your opinion, is the trend increasing or decreasing?

2005 and I think the trend is increasing

What were the extent of damages and monetary implications for the community?

We lost farmland on the floodplains as a result of siltation

What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?

I think is bad building plans and our closeness to the river

Has there been any local indigenous effort to discuss/implement mitigative interventions?

Yes local efforts to fortify the river banks

Was there any government initiative for flood mitigation in your local area?

The government offered to relocate communities but this was met with stiff opposition. The attachments this community has with the flood plain is cultural and for economic reasons. The alternative housing offered by government alienated the community from the source of live hood,

If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?

Yes, we were consulted but the option offered was rejected by the community.

Was the local community involved in any stage of consultation and planning?

No

What are your concerns about the socio-economic effects of flooding in the area?

Loss of live hood

In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?

Improve the drainage and fortification of the river banks.

How do you feel you can bring about the desired change in your area as far as flood protection is concerned?

Not sure

How would you like to be involved in flood mitigation decision making process? If so, to what extent?

From the planning stages

PARTICIPANT 20

Lau A Ward (Lau LGA) CL20, 27/01/2014

The interview was conducted at 12.30 pm on the 27/0212014.

How long have you lived/worked in the area (study area) and what are predominant land use type and activities?

For 23 years, we are mostly irrigation farmers in the dry season and fisherman during the raining season. So as you can see we are busy all year round.

How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?

I would say 4 flooding events

Which event was the most severe and how were you affected? In your opinion, is the trend increasing or decreasing?

I would say 2005 but 2012 was also bad. I am not sure if the trend is increasing or decreasing.

What were the extent of damages and monetary implications for the community?

We lost of farmlands on the flood plains due to siltation

What is your understanding of the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?

Excessive rains and the nature of our livelihood . We make a living from the river and we need to stay close. I agree some of our activities are affecting the rivers natural setting, for example, we divert some parts of the river to irrigate certain areas. We benefit from both seasons

Has there been any local indigenous effort to discuss/implement mitigative interventions?

Fortification of the river bank

Was there any government initiative for flood mitigation in your local area?

Government offered to relocate community

If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?

Only after the decision to relocate was taken

Was the local community involved in any stage of consultation and planning?

No

What are your concerns about the socio-economic effects of flooding in the area?

Plenty concerns. When the floods came in we lost some of our crops and a part of the community moved away. Loss of lives hood and social cohesion. But we settle back to continue our activities here.

In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?

Improved drainage and fortification of the river bank.

How do you feel you can bring about the desired change in your area as far as flood protection is concerned?

This is beyond the community capacity, we just manage.

How would you like to be involved in flood mitigation decision making process? If so, to what extent?

Yes at all levels.

PARTICIPANT 21

Shomo Sarki (Lau, LGA) CL21, 27/01/2014

The interview was conducted at 3 pm on the 27/01/2014.

How long have you lived/worked in the area (study area) and what are predominant land use type and activities?

I have lived here since I was born. I am 56 years old.

How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?

4 flooding events

Which event was the most severe and how were you affected? In your opinion, is the trend increasing or decreasing?

Ah that will be in 2005 and the bridge collapsed then, we have had similar floods in 2007, 2009, 2012 but the damages cannot be comparing to 2005. I don't know if it's getting worst. It keeps changing.

What were the extent of damages and monetary implications for the community?

Sand and sediments covered our farms land. We harvest nothing in 2005. We have low harvest during the other floods.

What is your understanding on the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?

It's the nature of how we live here. the population here is growing because of the business activities here. So more people, more houses and more pressure on the river

Has there been any local indigenous effort to discuss/ implement mitigative interventions?

We have lived here for years and we do discuss as a community on how to manage the rainy season challenges. During the dry season we sale the sand along the river to builders so as to increase the storage capacity of the river

Was there any government initiative for flood mitigation in your local area?

They offered to relocate us but the new place does not have the business opportunities we have here so we refused.

If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?

There were some consultation with the community but the outcome was not to our benefit. They just want us to leave this place

Was the local community involved in any stage of consultation and planning?

Yes, there were community consultations. We have to do this together

What are your concerns about the socio-economic effects of flooding in the area?

This is where we make a living, we send our children to school from what we make here. This is all we do. We do not have any other choice. We are at the mercy of the elements.

In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?

The government needs to dredge the river

How do you feel you can bring about the desired change in your area as far as flood protection is concerned?

That I don't know, we do not have the resource for any type of major intervention

How would you like to be involved in flood mitigation decision - making process? If so, to what extent?

Yes we as a community are willing.

PARTICIPANT 27

Mayo- Renewo (Ardo-Kola) CL27, 3/02/2014

The interview was conducted at 5pm on the 3/2/2014.

How long have you lived/worked in the area (study area) and what is predominant land use type and activities?

I was born here and we are fishermen and farmers

How many flooding events have you experienced in your time here? And are you aware of your communities' vulnerability?

I will say 4

Which event was the most severe and how where you affected. In your opinion, is the trend increasing or decreasing?

Definitely the 2005 event , I think the trend is increasing

What were the extent of damages and monetary implications for the community?

Loss of farmlands on the flood plains by siltation but when it floods we also catch a big harvest of fish

What is your understanding on the causes of flooding and what anthropogenic factors do you think could be contributing to its severity?

Excess rainfall and the nature of how our community is built. we are very close to the river

Has there been any local indigenous effort to discuss / implement mitigative interventions?

Yes local efforts to fortify the river banks, we also use sand bags to protect our house

Was there any government initiative for flood mitigation in your local area?

Yes a committee was set after some deliberations and government offered some compensation to some affected families. Some did not get any help. I myself refused any hand out as a protest to show my displeasure for the bia ways the materials were given .

If yes, to what extent have local officials and agencies engaged you or members of your community in any issues related to flood protection in your area?

Yes some meeting were held with the community , we have to do this together , they have to listen to us , the impacts are far beyond what we have seen , taking is the only reasonable way forward

Was the local community involved in any stage of consultation and planning?

Yes truly they came to us

What are your concerns about the socio-economic effects of flooding in the area?

Mainly is the concern about survival here as our activities are closely tied tour location.

In your own opinion, what flood management techniques could by applied for flood mitigation in your local area?

Government needs to improve the drainage system here

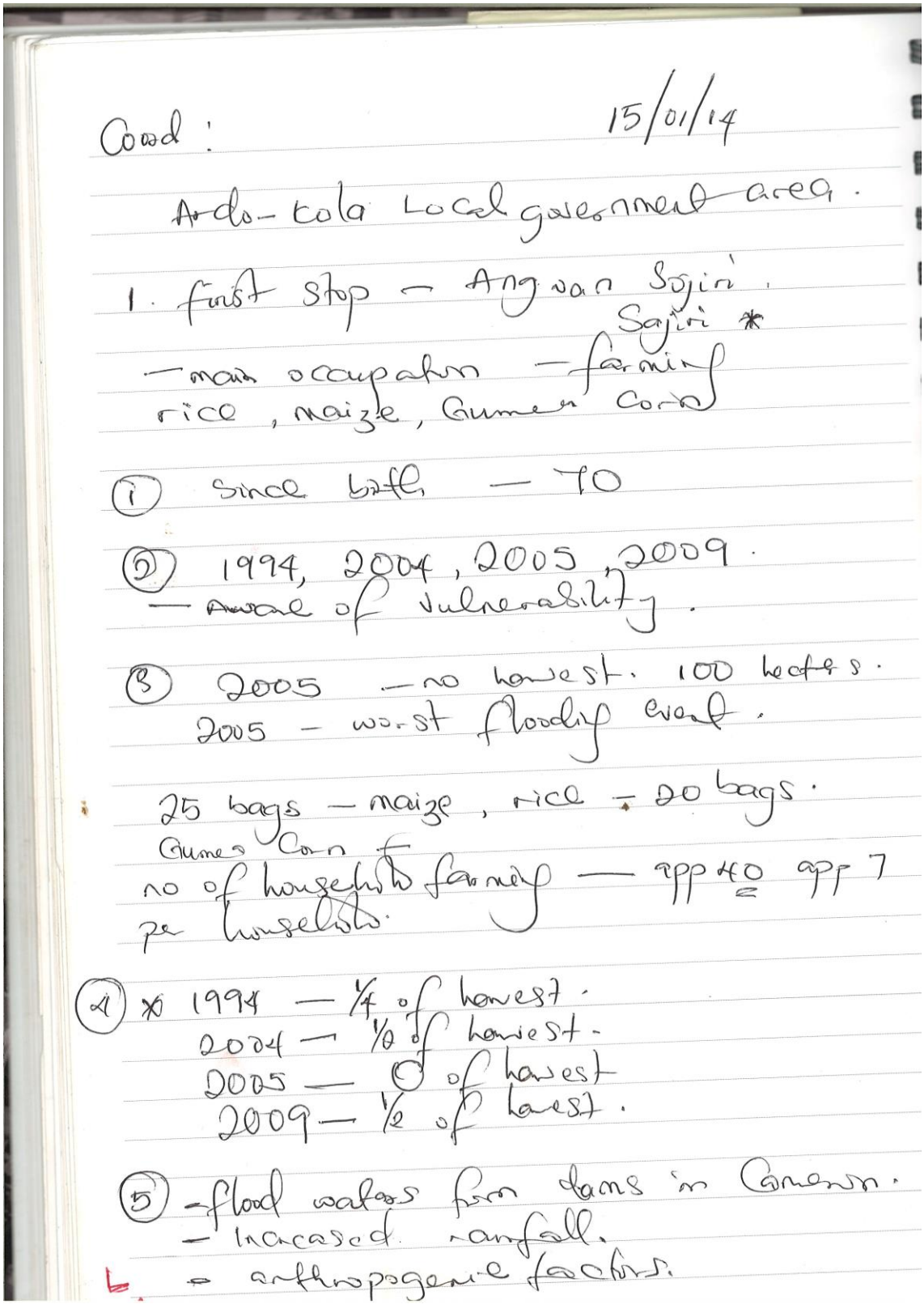
How do you feel you can bring about the desired change in your area as far as flood protection is concerned?

What can I say my daughter? How do you think we can communicate? This is beyond our capacity as a community

How would you like to be involved in flood mitigation decision - making process? If so, to what extent?

Yes we would like to be involved at every stage.

Appendix J: Field Notes



Good! 15/01/14

Ardo-kola Local government area.

1. first stop — Angwan Sajini.
Sajini *
— main occupation — farming
rice, maize, Guinea Corn

① since birth — 70

② 1994, 2004, 2005, 2009.
— Aware of vulnerability.

③ 2005 — no harvest. 100 heads.
2005 — worst flooding event.

25 bags — maize, rice = 20 bags.
Guinea Corn

no of household family — app 40 app 7
per household.

④ ✕ 1994 — ¼ of harvest.
2004 — ½ of harvest.
2005 — 0 of harvest
2009 — ½ of harvest.

⑤ - flood water from dams in Cameroon.
— Increased rainfall.
= anthropogenic factors.

Talipo.

Talipo and Ado Kola.

1. Since Birth — irrigation and rainy season farming — lower land and upper.
Rice — long grain rice farming.

2. 1989 10 years ago — more than 2005
* 2005 — govt elected communities.
* assessability of water, access to farms a political reason (registration), accessibility of Road, location of churches school. * Social problem, economic. Communities vulnerability.

3. 2005 — worked in the committee on flooding no harvest. Risk is low because of Govt efforts on mitigation 1.5 — 2 Billion in Cases.

5. deforestation, removal of sediments.
6. road. Rescue international.
7. Relocation, democracy on flood prone areas. Compensation.

8. Gov. to distribute relief materials 2005.
10. seek opportunities for flood prone areas.
Transition on youth on

Day (2)

Jauro Sofori

(1) Since birth. — main occupation farming rice, guinea corn, maize, dry season farming (irigation), Cassava.
— Cattle rearing, fishing

(2) Ten flooding events. 2011, 2005, 2009.
They are aware of their community vulnerability.
* no rainfall, no flooding affect food crops
(3) 2005. — fluctuating — extreme to low

(4) 2005 — no harvest. 2009 — 1/10 of harvest.
2011 — 1/2 of harvest.
Harvest 50 — 200 bags of grains.
Govt Report on dangers — accurate.

(5) Act of God, change in agricultural practices as types of crops & vegetation, anthropogenic factors — aware of the Communities contribu

(6) Discussion on River dredging.

(7) None. Turn to Kel

(8)

(9) Requested for assistance.

(10) loss of livelihood, loss of farmland as a result siltation & deposition of sand of farmla

Map - Renewo.
40 yrs - ago - extreme - but did not cause the extent of damage like 2005.

(1) Born in Map Renewo. occupation fishing village with little agricultural practices.

(2) 4 flooding events.
40 yrs years ago. 2005 (extreme). 2007, 2009, 2011. Aware of Communities vulnerability.

(3) 2005 - increasing.
(4) No farm produce but an abundance of fish.
(5) Release of flood water from Cameroon. No information.
(6) 2011 — over 1000 house. } verify results.
— over 100 hectors.
(7) none
(8) N/A.
(9) N/A.
Relocation because of floods.
(11) adequate communication of release of flood waters, improved drainage systems. seasonal release of flood water during the dry season.
(10) * Twist impact of dams on local veg and drainage.
(13) Yes from the reception.